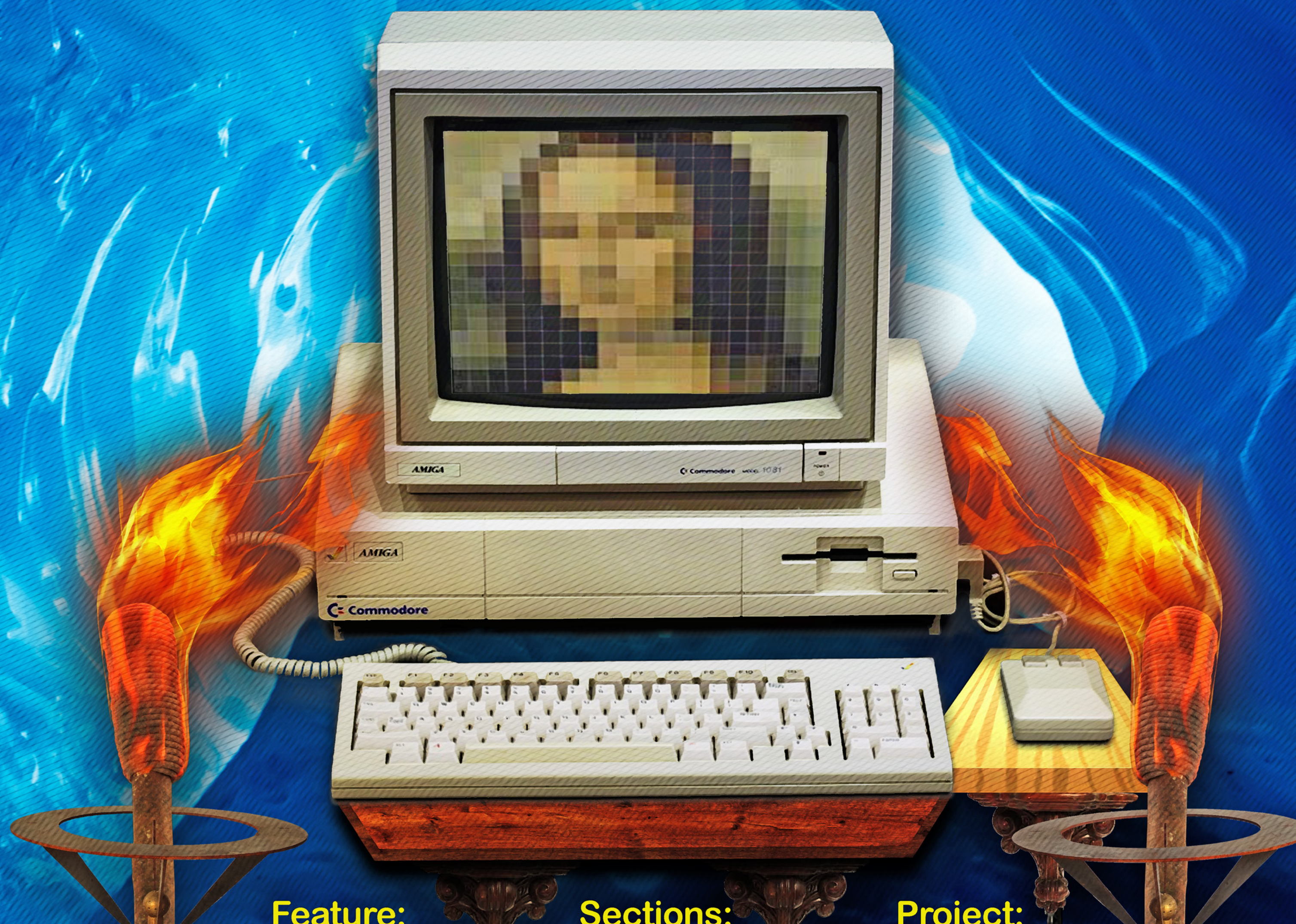
july 2019 vol 1. num. 5 a TECH publication

paleotronic

demonstrating creative applications of vintage technology

How The Cold Logic of Microchips and Code Kindled the Fire of Human Expression



Feature:

The wonderful Amazing artistic Amiga
she's a beauty!

then:
make money with Macintosh
desktop publishing

Sections:

Laser Fantasies of Don Bluth

Artistic Worlds of CD-ROM

Computer Music and the magic of SID

Project:

build a MIDI interface for the Apple II
play beautiful music!

also:
make turtle 'squirals'
the Logo spirograph

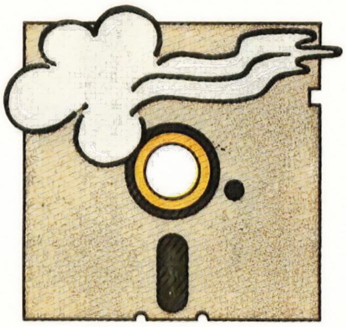
plus: the Yamaha CX-5M Music Computer
and so much more!

made with
love in
Australia

$9.99 US
$13.99 AU/CA
paleotronic.com

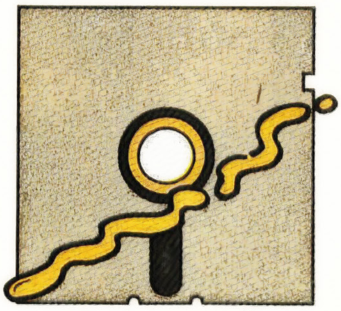
23 dumb ways for disks to die...

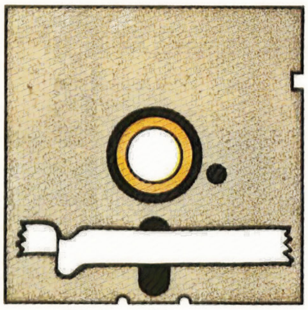

Regular coffee, two lumps

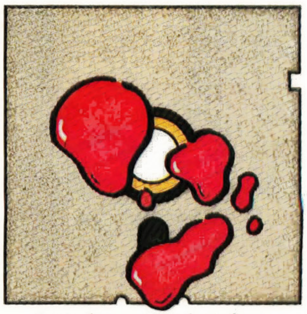

Clouds of smoke


Maria's liquid cover


The big chill

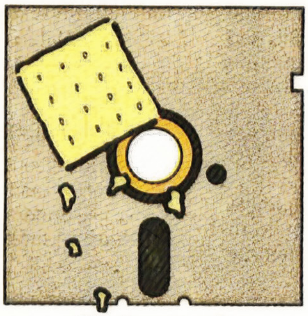

Hot dog mustard

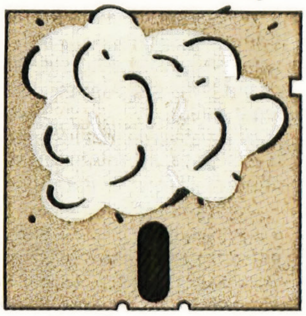

Tacky white tape

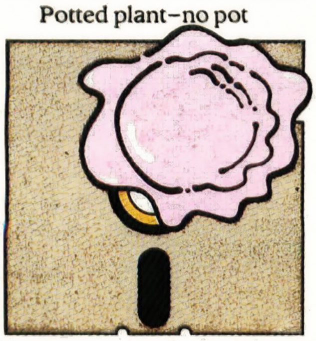

Lunchcounter ketchup


Potted plant–no pot

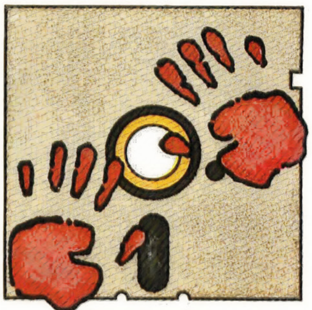

Fizzy orange soda

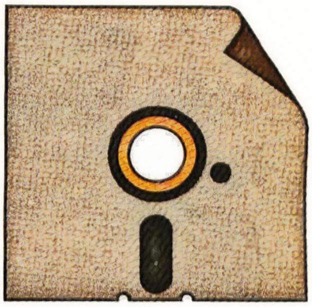

Cracker crumbs

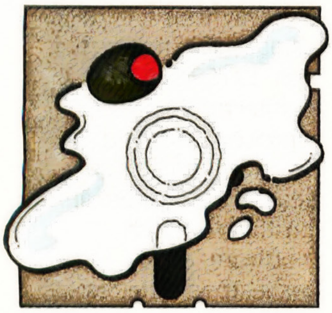

Dust (cough-cough)


One scoop of ice cream

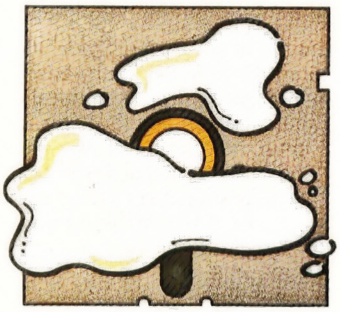

Sudsy soap bubbles


Chocolate fingerprints

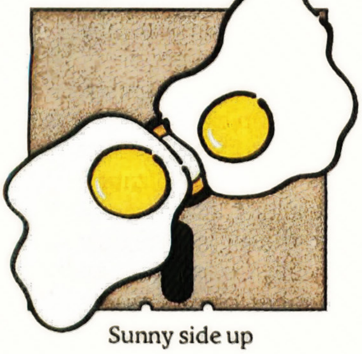

Dog-eared jacket


Dry martini, one olive

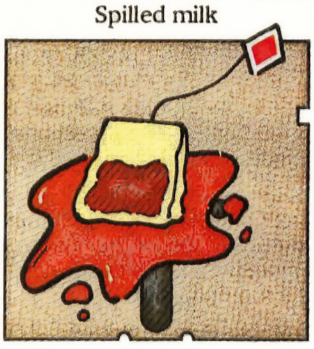

Boss's cigar ashes

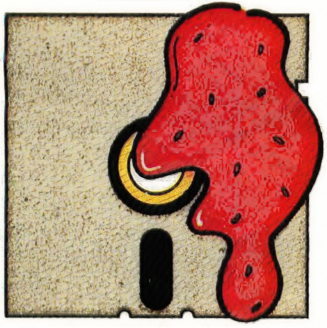

Spilled milk


Eraser bits

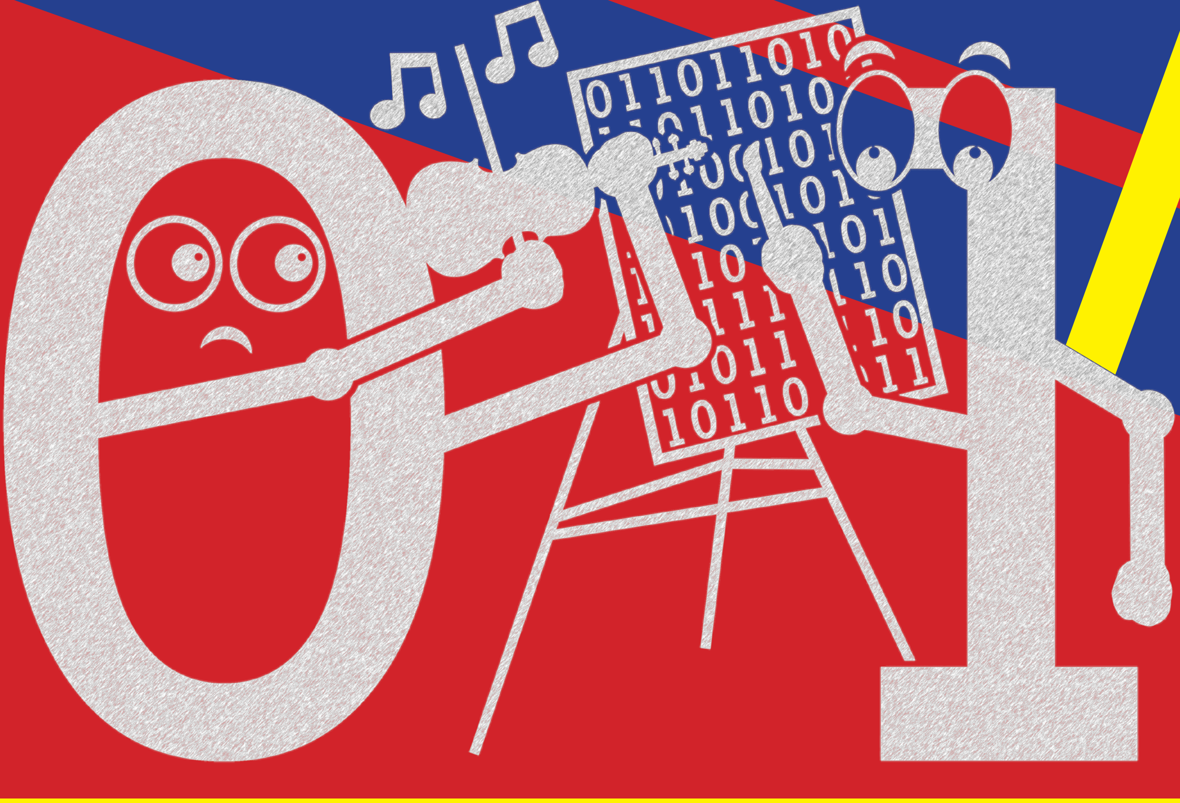

Sunny side up


Waterbased ink spots


English breakfast tea


Aunt Molly's jam

paleotronic



PROLOGUE

Zero plus one equals anything you can imagine.

This magazine was created with a computer.

I know, I know: "Thank you, Captain Obvious." But fifty years ago most people would have laughed at that statement, declaring it 'preposterous'. "Computers are for number-crunching!" they would have likely declared – "The cold logic of a computer will never be suited to any sort of creative endeavour. You might as well have said you made this magazine with a jackhammer."

And from a contemporary perspective they would have been right. Sure, computers were about to put a man on the moon, but beyond that, ballistic missile trajectories, income tax calculations and mailing out power bills, computers appeared to the general public be extremely utilitarian. Data in, data out. Punch cards and line printers.

How were you going to be creative with that? You couldn't even be 'creative' with your accounting anymore, thanks to all of these blasted computers – they may have been 'state of the art' but their usefulness in creating actual art was somewhat limited, beyond making baby mobiles out of punch cards or printing out ASCII 'photographs' of Mr. Spock (which was more of a copy than a creation, in any case).

And, from that standpoint, our voices from the past would have been correct in their objection. But they would have also been guilty of underestimating the power of the human creative spirit, and the enduring compulsions some of us have to apply our own personal sense of aesthetics to any and all mediums available to us.

Including those associated with the computer, which soon grew beyond mere cards and paper.

With

the computer

Management ooh-ed and ahh-ed and started to think these computer thingies might be useful afterall.

Scientists began to devise methods of visualising their data – because not everyone can simply glance at a bunch of numbers and understand how they make sense or if they even make sense at all. And they had to explain this stuff to the people who controlled the purse-strings.

So they started using ASCII (or EBCDIC on IBM mainframes) characters to draw rudimentary charts and graphs on paper printouts. Oscilloscope tubes were fashioned into crude vector-based displays. Management ooh-ed and ahh-ed and started to think these computer thingies might be useful afterall. They spent more money on them. This created demand for better output devices, and computer manufacturers, eager to sell even more products, listened.

They developed plotters, which made much better charts and graphs than line printers did – and in colour too! They improved on the oscilloscope-based displays, creating more sophisticated vector and raster (scanline)-based displays, eventually introducing colour there as well. As time wore on, these output peripherals became capable of presenting quite sophisticated graphics, and users wanted to take advantage of that, inserting their own 'clip-art' images. But they would have to draw them manually, on a keyboard, one pixel or point at a time, which was tedious and extremely time-consuming.

Once again, a potential demand was identified and the engineers at the big computing companies sprang into action. The joystick was offered as an option, not for games, but as a way to control a text cursor or an electronic paint brush. But while this was slightly better than a keyboard it didn't offer the fine-grained control necessary for drawing anything more than a disjointed scribble at any rate higher than a few pixels at a time.

The trackball, invented for use with radar systems after World War II, was much more suited to drawing, as relative distances could be calculated without relying on the passage of time (as with a joystick). Although this was an improvement, it was still fixed in place and didn't sufficiently replicate the motions involved in drawing or painting.

A truly revolutionary (and evolutionary) solution would need to be found.

There came to be three candidates: a handheld device dubbed the 'mouse', an upside-down trackball which the user pushed around on a flat surface (usually a table), a 'pen tablet' that detected the position of a stylus on its surface using various means, and the light pen, which detected when a CRT's electron gun shot past its position, identifying its location in front of the screen.

While the ability to draw directly on the display was certainly attractive, the light pen's brief popularity waned after users found it difficult to use for long periods of time (unless you mounted your CRT into your desk!)

The pen tablet fared better, with some models doing better than others, depending on the method they used to detect the position of the stylus. Some used magnetics (with the pen detecting its position on the tablet, or the tablet detecting the position of the pen over it), some used acoustics (the stylus would 'click' and microphones at the edges of the tablet would listen for it), and some were touch-sensitive, such as the KoalaPad, the first tablet for home computers.

But while the pen tablet was a good solution for drawing, it wasn't really suited for driving a user interface. The light pen was best at that but remained awkward to use vertically. However, the mouse, with its smooth gliding motions, placement on the desk which supported the users arm (unlike the light pen or pen tablet) and relative and consistent positioning (which allowed the user to quickly learn how distances moved by the mouse translated to movement of the cursor or pointer on the screen) soon emerged as a good compromise between all of these.

The mouse was victorious, although tablets and trackballs can still be purchased in their modern incarnations today,

As time wore on, these output peripherals became capable of presenting quite sophisticated graphics.

We

With the mouse came the invention of higher and higher resolution graphics displays.

and touchscreens, the modern-day equivalents of the light pen arguably now rule the roost when it comes to creative input devices, particularly on the iPad.

With the mouse came the invention of higher and higher resolution graphics displays – the monochrome screen of the original Macintosh, whose clarity allowed for the introduction of 'desktop publishing' and marked the dawn of computerised graphic design, and the video chip inside the Commodore Amiga with its palette of 4096 colours could produce images comparable to those seen via contemporary broadcast television.

The VGA graphics standard meant the PC would eventually overtake both the Macintosh and the Amiga, and the introduction of Microsoft Windows cemented its dominance through to the present day. Flatbed scanners and digital cameras made it easier to capture physical drawings or images of real-world objects, video and film followed, and ultimately most of the visual-arts world became binary.

(Even with physical mediums such as paintings or sculptures, a computer is often involved somewhere in the process of its creation, in its design, the inspiration behind it or even in its production. Maybe its creator watched a tutorial on YouTube!)

However, it's not just visual art that was changed by the computer, or the technology behind it. The first electronic instrument, the theremin, was followed by the electronic organ, and then more sophisticated music synthesisers. The emerging entertainment art form of video games was enhanced by sound chips, which produced simple tones and noise at first, but quickly evolved as arcade machines and consoles with better sound tended to make more money.

These sound chips found their way into home computers (at first to make them more attractive for video gaming); some (such as the Sound Interface Device or SID chip inside the Commodore 64) were more sophisticated than even those in most contemporary video arcade games or synthesisers. Soon, computers were being used to make music – not just for games, but as added accompaniment to songs made with acoustic instruments and synthesisers.

It soon became apparent all of these electronic devices – instruments, mixers, recording equipment and even amplifiers – could be controlled by computers, using extended versions of software that had already been developed for creating music with them, known as sequencers or trackers. The MIDI (Musical Instrument Digital Interface) protocol and electronic standard was developed as a result, and devices that contained a MIDI interface could connect to and be controlled by a MIDI-compatible computer (such as an Atari ST).

Higher amounts of memory and storage and better sound chips soon meant computers could record, store and play back high-quality digital audio, and music sequencing software evolved to allow these recordings to be synchronised with MIDI-connected instruments. Eventually, computer processors would become fast enough that these external electronic instruments could be simulated through software, and acoustic instruments would be recorded so comprehensively that almost every nuance of their character could be replicated at the rapidly diminishing expense of gigabytes and gigabytes of data.

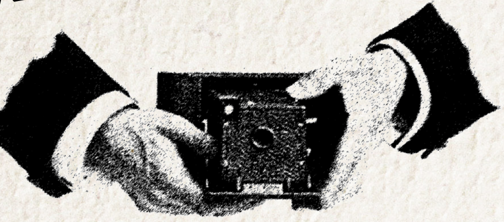
Of course, as a result of piracy the computer has also had a negative effect on creative industries – first music, then video and film – but it can be argued this has been more than offset by the opportunities the computer has created for many an artist or musician.

With the computer, we created.

Soon, computers were being used to make music – and not just for games.

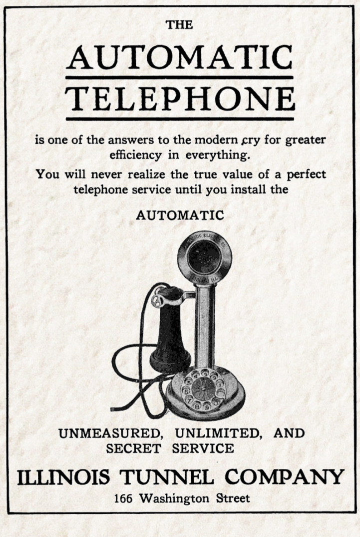
created

AN EXHIBITION OF



PALEOTRONIC

Sponsored
in part
by:



THE
AUTOMATIC
TELEPHONE

is one of the answers to the modern cry for greater efficiency in everything.

You will never realize the true value of a perfect telephone service until you install the

AUTOMATIC

UNMEASURED, UNLIMITED, AND SECRET SERVICE

ILLINOIS TUNNEL COMPANY
166 Washington Street

Victor

Look for the dog on the horn and cabinet of every Victor, on the lid of every Victrola, and on every Victor Record

Victor I
$25

Other styles
$10 to $250

The world's greatest musical instrument.

Think of getting for $25 a musical instrument that brings to you the voices of the most famous singers, the music of the most celebrated bands and instrumentalists—the best entertainment of every sort.

Never has $25 bought so much pleasure.

The proof is in the hearing. Ask the nearest Victor dealer to play one of Farrar's newest records, "Vissi d'arte e d'amor" from Tosca (88192)—a beautiful record and one that well illustrates the wonderful advances recently made in the art of Victor recording.

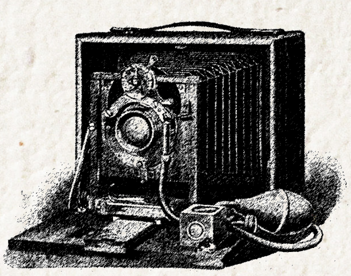
See that he uses an **Improved Victor Needle** to play this record.

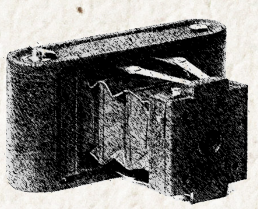
And while you are there **be sure to hear the Victrola.**

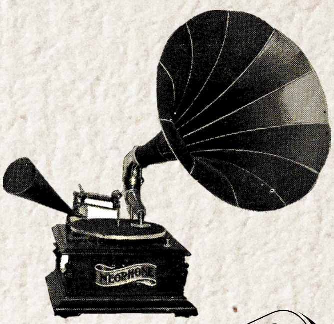
Victor Talking Machine Co., Camden, N. J., U.S.A.
Berliner Gramophone Co., Montreal, Canadian Distributors.

New Victor Records are on sale at all dealers on the 28th of each month

SCHEDULE OF







MAGAZINE

SIGHT AND SOUND

There is no Kodak but the Eastman Kodak.

Holidays are Kodak Days

Folding Pocket Kodak $10.

Indoors and Out the holiday season is a delightful one for amateur photography, making the Kodak an especially welcome **Christmas Gift.**

The Christmas tree, groups of friends at the dinner table or at the card party are all fascinating subjects for the flash-light and the winter days give ample opportunity for indoor portraiture, while outside, the barren, wind swept fields, or the trees covered with their feathery mantles of white offer unlimited possibilities to the amateur artist.

Flash-light pictures and daylight pictures are easy with a Kodak.

KODAKS $5.00 to $35.00.

EASTMAN KODAK CO.
Rochester, N. Y.

Catalogues free at the dealers or by mail.

The Royal Is All That Its Name Suggests—
the KING Among Phonographs

Style "A"

ROYAL PHONOGRAPH CO., Inc.
606 Courtlandt Ave. New York City

Agencies Are Now Open—Write Today

$15 for this genuine Victor-Victrola

Victor-Victrola IV, $15

Equipped with all the latest Victor improvements, including Exhibition sound box, tapering arm, "goose-neck", ten-inch turntable and concealed sound-amplifying features.

Other styles of the Victor-Victrola $50, $75, $100, $150, $200, $250

Victors $10 to $100

The fact that this instrument bears the famous Victor trademark and is a *genuine* Victor-Victrola guarantees to you the same high quality and standard of excellence so well established and recognized in all products of the Victor Company.

There is no reason on earth why you should hesitate another moment in placing this greatest of all musical instruments in your home.

All we ask is that you go to any music store and hear this new Victor-Victrola.

Victor Talking Machine Co., Camden, N. J., U. S. A.
Berliner Gramophone Co., Montreal, Canadian Distributors
New Victor Records are on sale at all dealers on the 28th of each month

For the best the 20th century has to offer, get Paleotronic. It's the bees knees!

SPECTACLES

Once upon a time…

…in a land far away lived Jack and Jay. Jack was the Commander of an armada known as Commodore, while Jay was a Grand Wizard in the royal court of the Kingdom of Atari.

Commander Jack had built up his armada over a period of thirty years. An immigrant from a distant land, he had his start driving water taxis in the harbour of New Amsterdam, and had gradually constructed his fleet, amassing a fortune first by shipping bean-counting machinery and later by manufacturing and distributing his own magical bean-counting devices – devices that could also educate and amuse the young folk, which made his bean-counting devices very popular amongst the lower-classes, who were penny-wise out of necessity.

However, Commander Jack wasn't the only one to find his fortune in magical bean-counting machines. King Nolan of the neighbouring land of Atari had seen the potential of the machines, but had dispensed (at least superficially) with the bean-counting component, offering them to his subjects purely for the purposes of amusement, even opening public houses dedicated to the exhibition of these machines.


King Nolan of Atari

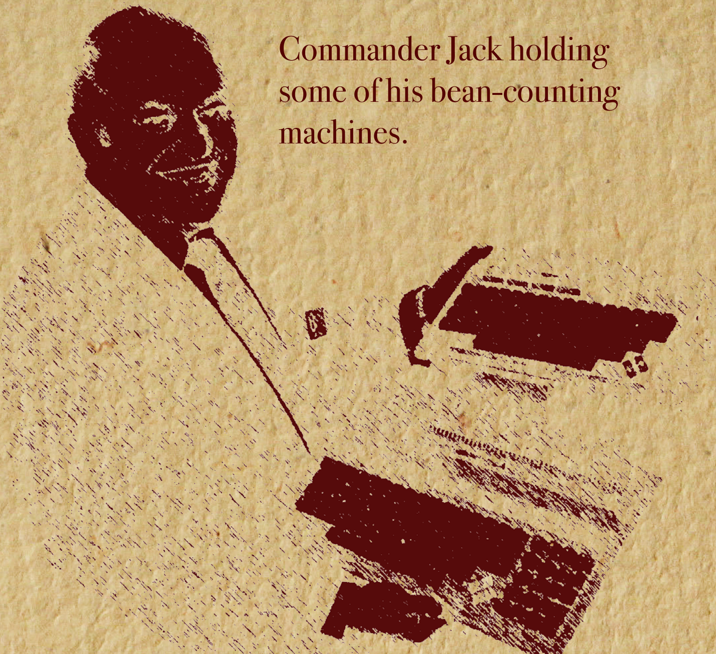
But the King had a grander vision, to give each of his subjects one of the machines for use in their own dwellings. However, the machines cost a great deal and so King Nolan called on his Grand Wizard, Jay, tasking the sorceror with finding new ways of enchanting the machines to make them less expensive to produce. Jay succeeded by conjuring a race of fairies called the Stellas – each machine would house a Stella, who would work tiny gears and levers inside. Unfortunately, in the process the kingdom's treasury had run empty – while the machine had been perfected, King Nolan no longer had any more gold with which to manufacture them.

He began to worry that another kingdom might offer the machines to its subjects before he could, causing his own subjects to leave him, and so King Nolan made a bargain with a devil called Warner, who offered to give him the gold he needed but in exchange he would be king in title only, no longer making the decisions – the devil Warner would write all of his decrees.

The Stellas were produced by the thousands and distributed to the citizens of Atari, who were happy and content.

BACK IN

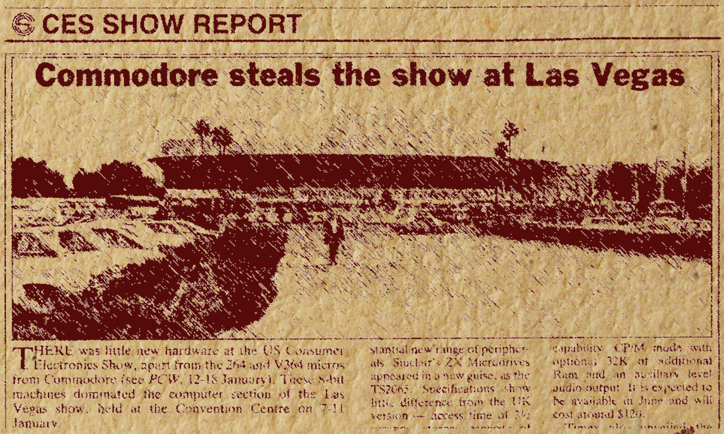

Commander Jack of the Commodore Armada



Commander Jack holding some of his bean-counting machines.

Soon, the devil Warner became concerned about news from other kingdoms that bean-counting machines sold by Commander Jack and others – the ones that could both amuse and do business – might become more popular than the Stellas and he might lose his grip on the kingdom of Atari. And so Warner ordered the Wizard Jay to create two bean-counting machines: one more for amusement but capable of some business, and another more capable for business, but more expensive. Wizard Jay complied, conjuring two new races of fairies: the more playful Candies and the more serious Colleens.

But the devil Warner wasn't content to simply offer the machines to Atari's subjects. The new machines were also offered at markets in other kingdoms – raising the ire of Commander Jack, who worked to create new, more affordable magical bean-counters of his own.



CES SHOW REPORT

Commodore steals the show at Las Vegas

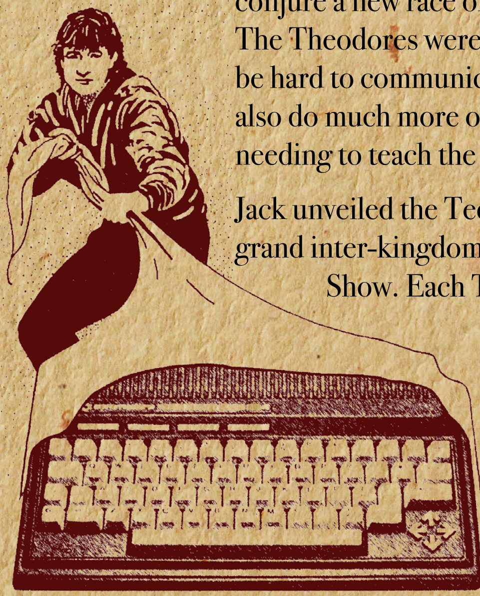
THERE was little new hardware at the US Consumer Electronics Show, apart from the 264 and V364 micros from Commodore (see *PCW*, 12-18 January). These 8-bit machines dominated the computer section of the Las Vegas show, held at the Convention Centre on 7-11 January.

stantial new range of peripherals. Sinclair's ZX Microdrives appeared in a new guise, as the TS2065. Specifications show little difference from the UK version — access time of 3½

capability CP/M mode with optional 32K of additional Ram and an auxiliary level audio output. It is expected to be available in June and will cost around $120.

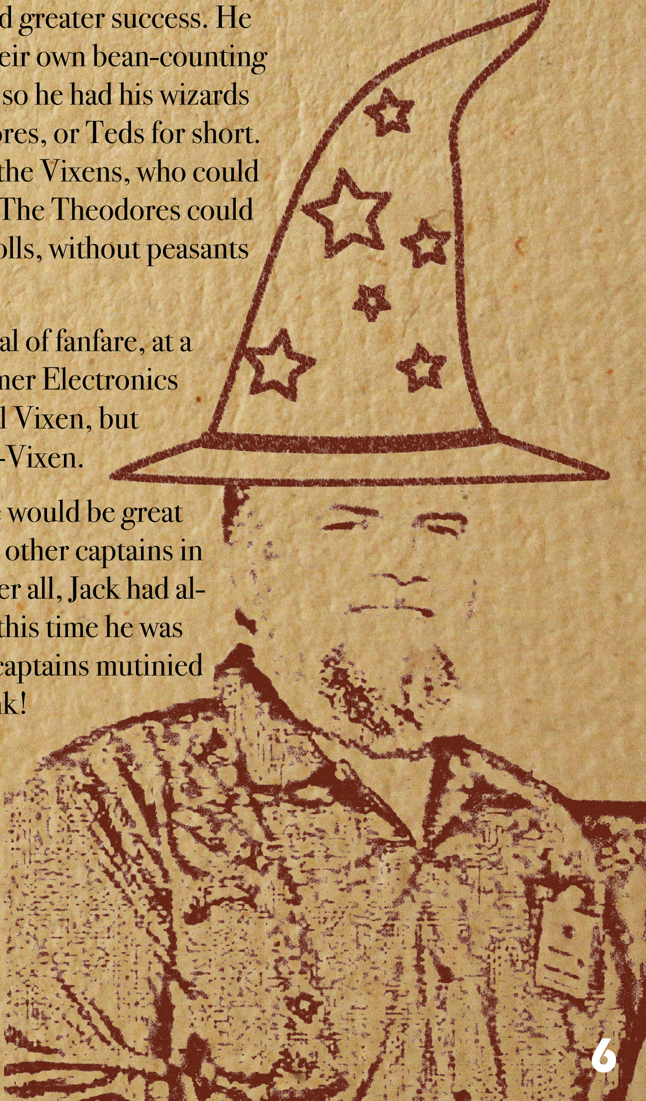
Jack hired his own wizard to create a contraption that held fairies, but he called his fairies the Vixens. His Vixen-powered machines were much cheaper than the Candy-powered ones; they were also inferior in their function but Jack wisely reasoned that many peasants would find the Vixens sufficiently talented to entertain them and their offspring, and he did a brisk trade. As time marched on, his wizard learned to conjure more sophisticated Super-Vixens who could do as much as Atari's Colleens, but also more cheaply.

Jack's wealth continued to grow, but so did his hunger for greater and greater success. He longed to destroy the devil Warner and other kingdoms that made their own bean-counting machines – the kingdom of the Apple, and the Realm of Tandy – and so he had his wizards conjure a new race of faries Jack called the Theodores, or Teds for short. The Theodores were easier to get along with than the Vixens, who could be hard to communicate with and temperamental. The Theodores could also do much more on their own, such as write scrolls, without peasants needing to teach the fairies themselves.



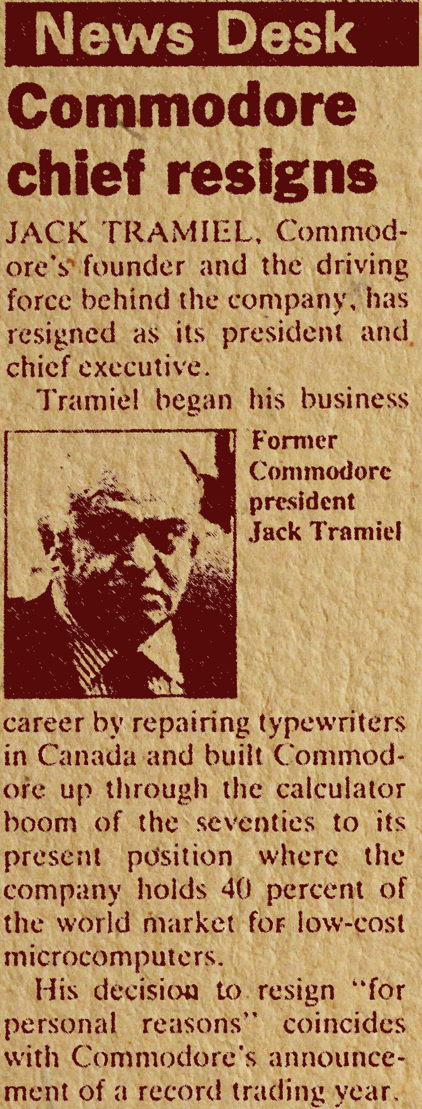
Jack unveiled the Teds to the world with a great deal of fanfare, at a grand inter-kingdom market known as the Consumer Electronics Show. Each Ted was better than an original Vixen, but more affordable than a Super-Vixen.

Jack was convinced that there would be great demand for the Teds, and the other captains in his fleet had gone along – after all, Jack had always been right before. But this time he was wrong: Ted was a flop. The captains mutinied and made Jack walk the plank!



THE DAY

The Grand Wizard Jay from the Kingdom of Atari



News Desk

Commodore chief resigns

JACK TRAMIEL, Commodore's founder and the driving force behind the company, has resigned as its president and chief executive.

Tramiel began his business career by repairing typewriters in Canada and built Commodore up through the calculator boom of the seventies to its present position where the company holds 40 percent of the world market for low-cost microcomputers.

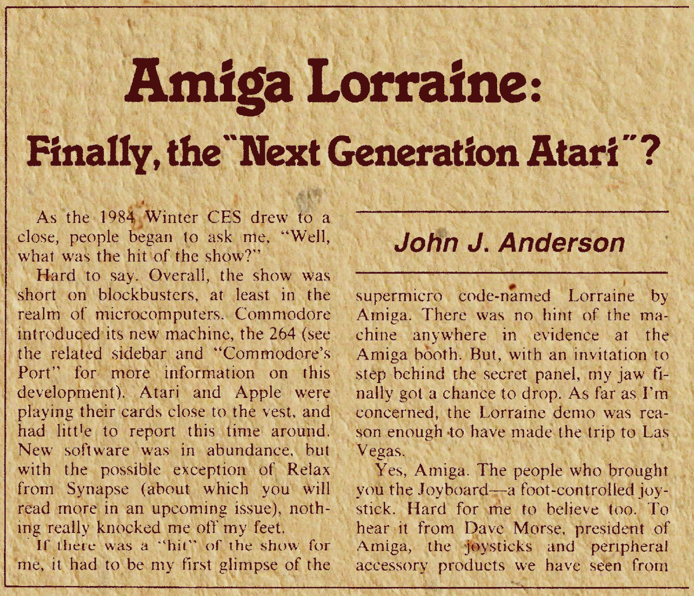
His decision to resign "for personal reasons" coincides with Commodore's announcement of a record trading year.

Former Commodore president Jack Tramiel

Luckily Commander Jack was rescued by his sons Sam and Leonard, and the three sailed away, Jack insisting all the while that it wasn't because of Ted he was forced to leave but because the leader of the mutineers had been stealing the fleet's gold for himself and had simply seized the opportunity to be rid of him. Nobody knows the truth, but either way, Jack vowed revenge.

Meanwhile, there was trouble in the kingdom of Atari. Over the previous several seasons there had become a great demand for scrolls written with new talents to teach the Stellas, and Atari had done a heavy trade in them. Other kingdoms began to write scrolls themselves, and sell them to Stella owners against the laws of Atari. But while these outside scrolls were cheaper they were also of inferior quality, and the populace began to complain. Eventually they stopped buying new scrolls entirely, and Atari's coffers began to empty faster than they were being filled.

> Commander Jack was not amused after he was forced out of his fleet, the fleet he had built up from nothing, but he had plans to get revenge – plans that could be derailed by the efforts of Wizard Jay, now a rogue operative.



Amiga Lorraine:

Finally, the "Next Generation Atari"?

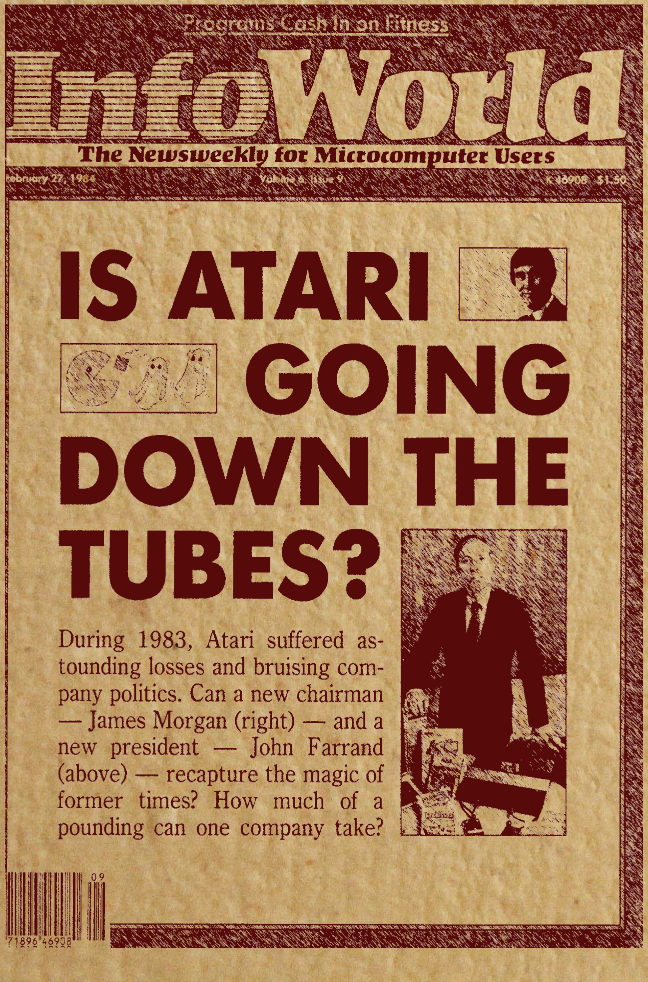
John J. Anderson

As the 1984 Winter CES drew to a close, people began to ask me, "Well, what was the hit of the show?"

Hard to say. Overall, the show was short on blockbusters, at least in the realm of microcomputers. Commodore introduced its new machine, the 264 (see the related sidebar and "Commodore's Port" for more information on this development). Atari and Apple were playing their cards close to the vest, and had little to report this time around. New software was in abundance, but with the possible exception of Relax from Synapse (about which you will read more in an upcoming issue), nothing really knocked me off my feet.

If there was a "hit" of the show for me, it had to be my first glimpse of the supermicro code-named Lorraine by Amiga. There was no hint of the machine anywhere in evidence at the Amiga booth. But, with an invitation to step behind the secret panel, my jaw finally got a chance to drop. As far as I'm concerned, the Lorraine demo was reason enough to have made the trip to Las Vegas.

Yes, Amiga. The people who brought you the Joyboard—a foot-controlled joystick. Hard for me to believe too. To hear it from Dave Morse, president of Amiga, the joysticks and peripheral accessory products we have seen from



Programs Cash In on Fitness

InfoWorld

The Newsweekly for Microcomputer Users

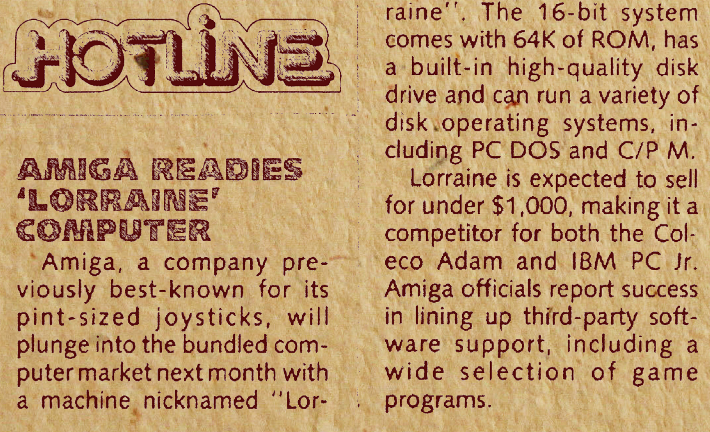
ebruary 27, 1984 Volume 6, Issue 9 K 46908 $1.50

IS ATARI GOING DOWN THE TUBES?

During 1983, Atari suffered astounding losses and bruising company politics. Can a new chairman — James Morgan (right) — and a new president — John Farrand (above) — recapture the magic of former times? How much of a pounding can one company take?

To make matters worse, the devil Warner had denied Grand Wizard Jay's request to create a new bean-counting machine and Jay had grown bored and left the kingdom. With no wizard and its subjects tired of the Stellas, Candies and Colleens, Atari found itself in trouble, and the devil Warner quickly wanted to be rid of the kingdom.

One day former-commander Jack and his sons sailed into Atari's port. The devil Warner saw an opportunity to unload the bankrupt kingdom on a former competitor, not particularly caring how it turned out, only wishing to return back to Hell. Jack agreed. He was going to create a more sophisticated class of fairies, one that was more intelligent and capable than what had come before.



HOTLINE

AMIGA READIES 'LORRAINE' COMPUTER

Amiga, a company previously best-known for its pint-sized joysticks, will plunge into the bundled computer market next month with a machine nicknamed "Lorraine". The 16-bit system comes with 64K of ROM, has a built-in high-quality disk drive and can run a variety of disk operating systems, including PC DOS and C/P M.

Lorraine is expected to sell for under $1,000, making it a competitor for both the Coleco Adam and IBM PC Jr. Amiga officials report success in lining up third-party software support, including a wide selection of game programs.

NEWS

HOME COMPUTERS

BOLD PLANS FOR 'NEW' ATARI

Tramiel threatens to shake up 'dull' home computer market

BY KATHY CHIN
Reporter

The podium placard, which read "The New Atari Corp." in bold white lettering, made the distinction very clear. In their first news conference since Jack Tramiel took over in July, Atari officials emphasized that the old Atari, its old management, and its old advertising strategies are dead and gone. Tramiel's new Atari, with a new management team (mostly from Commodore) and secret plans for a new line of 8-, 16-, and 32-bit computers and peripherals, hopes to breathe "new life" into the home computer market.

Tramiel, who founded Commodore Business Machines in West Chester, Pennsylvania, resigned abruptly from his sensationally successful home computer firm at the beginning of the year. He suddenly returned to the home computer scene in July when he purchased troubled Atari of Sunnyvale, California, from Warner

Meanwhile, the firm's engineers and marketing experts are preparing two 8-bit computers, at least two 16-bit computers, and a 32-bit home computer for release next year. The products will range in price from $100 to $1,000.

According to Sam Tramiel, the eldest of Tramiel's three sons, the cases of all Atari's new machines are being designed by Ira Velinsky, Atari's director of industrial design. Velinsky is a former

line is manufactured in Taiwan and Ireland.

Sam Tramiel also confirmed a rumor that GEM, a newly announced software operating environment from Digital Research Inc. of Pacific Grove, California, will be part of Atari's proprietary operating system in the new computers. Digital Research has worked "very closely" with Atari, said Sam Tramiel. GEM, or Graphics Environment Manager, features icons, pull-down menus, and overlapping windows, the same features made popular on Apple's Lisa and Macintosh computers.

In the area of software, Atari is talking with third-party developers, said Sigmund Hartmann, new president of Atari software worldwide and former vice president of software at Commodore. "There are a helluva lot of talented third-party developers available out there. We are talking to a lot of them."

Hartmann said he has already been speaking to home software companies such as Infocom of

He would use the new fairies to get his revenge on the mutineers that had stolen his fleet, the mutineers content with their existing fairies, and vulnerable to losing their market. But as he looked through Atari's scrolls he discovered that the kingdom had lent a large sum to the former Grand Wizard Jay, who had gone off on his own to also create a new generation of fairies he called the Lorraines. Jack had visited the Grand Wizard Jay before sailing to Atari, but while he had been interested in Jay's fairies he wasn't interested in Jay or his underlings. Jay and Jack had been unable to come to an agreement and Jack sailed away, instead quietly recruting crewmen away from the Commodore fleet to help him develop his own fairies.

Jay got wind of the fact that Jack was working on his own fairies, but wasn't worried because Jack had no fleet or kingdom. However, once he heard Jack was in Atari, Jay began to panic.

Realising that his funding was about to be cut off, Jay and company went to the Commodore Armada, thinking that the fleet would be desperate for the Lorraines, their having need of a new bean-counting machine to compete with Jack's. The Commodore captains declined to give any gold to Jay, offering instead to join Jay's crew to their own. They agreed.

Commodore then attempted to convince the other kingdoms not to buy Jack's Atari-manufactured fairies before he had manufactured them, claiming that Jack's crew had stolen their fairie recipes from Commodore when they had left. But then Jack found the agreement between Atari and Jay, which stated that Atari had first-rights to Jay's fairies, whether they used them or not. Jack in turn attempted to persuade the other kingdoms not to buy anything from Commodore that used Jay's fairies! They were at an impasse.

Commodore's captains attempted to return the gold Atari had given to Jay but Jack refused to accept it. Jack continued to attack Commodore through the inter-kingdom legal system, while ignoring Commodore's own attacks and pressing ahead with his new bean-counting machine powered by fairies he named the Sam Tramiels, after his son, or the STs. Commodore eventually decided they had no choice but to push ahead with releasing the Lorraines, which they rechristened the Amigas.

With the conflict between them at a stalemate, both the Kingdom of Atari and the Commodore Armada would set their fairies loose on the world, and they all lived happily ever after, or for a while, at least. Until the Microsoft Empire turned up, anyway…

AUGUST 5, 1985 VOLUME 7, ISSUE 31 $2.25 (CANADA) $1.75 (U.S.)

InfoWorld

THE NEWSWEEKLY FOR THE MICROCOMPUTING COMMUNITY

WILL THE AMIGA CHALLENGE APPLE?

KEVIN JENKINS,
HERCULES
PAGE 16

NEWS

FIGHT OVER FAKE BOARDS

PROPRINTER HAS MAKERS SCRAMBLING

TRENDS

2,400-BPS MODEM USE ACCELERATES

REVIEWS

4 KEYBOARD ENHANCERS COMPARED

JAY MINER
COMMODORE/AMIGA

Or something like that…

The Amiga represented an evolutionary leap forward in computing's creative potential.

While colour computer graphics were not a new invention, the Amiga provided a video mode capable of displaying 4096 colours – previously unprecedented in a consumer computer.

This allowed for stunning photo-realistic images.

Not only a feast for the eyes, but the ears too!

The Amiga also featured four digital sound channels that could play back samples directly from the computer's memory, reproducing acoustic instruments and vocal tracks, and bursting forth surprisingly good musical arrangements.

The Amiga 1000, released in 1985.

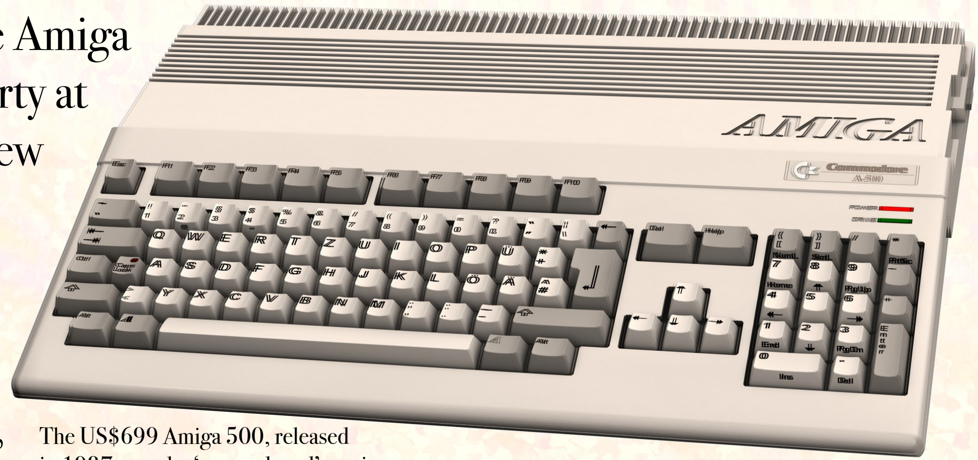
The AAAAAmazing AMIGA

On July 23rd, 1985 the Amiga premiered at a lavish party at the Lincoln center in New York City.

We'll be ducking our heads into that event a little later, but first let's take an in-depth look into just what they were celebrating.

'The Amiga by Commodore'

Jay Miner's masterpiece was exactly that.



The US$699 Amiga 500, released in 1987, was the 'cost reduced' version of the US$1285 Amiga 1000 (opposite page) designed to be more affordable and compete with Jack Tramiel's Atari ST.

To understand just how much of a masterpiece it was, you need to have a sense of the personal computing market of the day. Most computers still being sold in 1985 were 8-bit and had very simple graphics with modes with less than 200 horizontal pixels and at most 16 colours (the Atari 400/800 series had additional 'shades' but there were still only 16 base colours.) Many people still owned computers capable of much less.

Even the 16-bit Macintosh only had monochrome (in the truest sense – a pixel could only be either black or white) graphics at 512x342 pixels, which was great for print publishing but if you wanted to express even a single a shade of gray you needed to use halftoning, which decreased your effective resolution to half of that. And so the idea of a consumer machine with 4096 colours to choose from and resolutions of up to 640x512 pixels that cost less than half that of a Macintosh was shocking to say the least. Add on top of that four-channel digital sound (the Macintosh had one, and most contemporary 8-bit computers had analogue synthesisers of varying complexity) and you had a computer that seemed to most users like a technological fantasy that popped out of a wormhole from the future, not something they could just go out and buy from their local computer shop next week.

News Desk 01-437 4343

Amiga launched in US

COMMODORE'S much feted Amiga machine was launched last week at the Lincoln Centre in new York.

Over 800 people attended the launch, including artist Andy Warhol who was called upon to demonstrate the micro's impressive graphics capabilities.

The Amiga will cost $1295 (about £925) in the US, and is expected to reach the shops there this September.

The package will comprise the keyboard, single 3½inch disc drive and mouse. The hi-res colour monitor is an extra at $495 (£350).

No software is being bundled with the machine, apart from Microsoft's version of Basic, although Commodore is hoping that by the time the micro is released, there will be between 30 and 40 titles available.

These include business suites from Chang Laboratories and Software Group, graphics programs from Island Graphics, music packages from Cherry Lane Technologies, programming utilities from Lattice and Metacomco and at least 30 entertainment packages from Electronic Arts, Mindscape, Broderbund, Synapse, SubLogic and Infocom. Well known titles include *One on One*, *Skyfox*, *Sargon III*, *Chess*, *Sub Logic Flight Simulator* and the complete Infocom range including *Hitch Hikers Guide to the Galaxy*.

The IBM emulator disc is also expected to be available in September. "The IBM emulator will be under $100, and there will also be an accelerator available for under $100, which means that software such as *Lotus 1-2-3* will run just as fast as it does on the PC. Without the accelerator the PC software does run slower," said a spokesman for Commodore US.

There is still no firm da being given for the Amiga arrival in the UK. Comm dore will be concentrating the C128 the *Perso* *Compute* *World* Sh in Septe ber, and t nearest t Commodore UK w commit self is t first quart of ne year.

ARRIVA AMIGA!

Commodore's 16-blitter

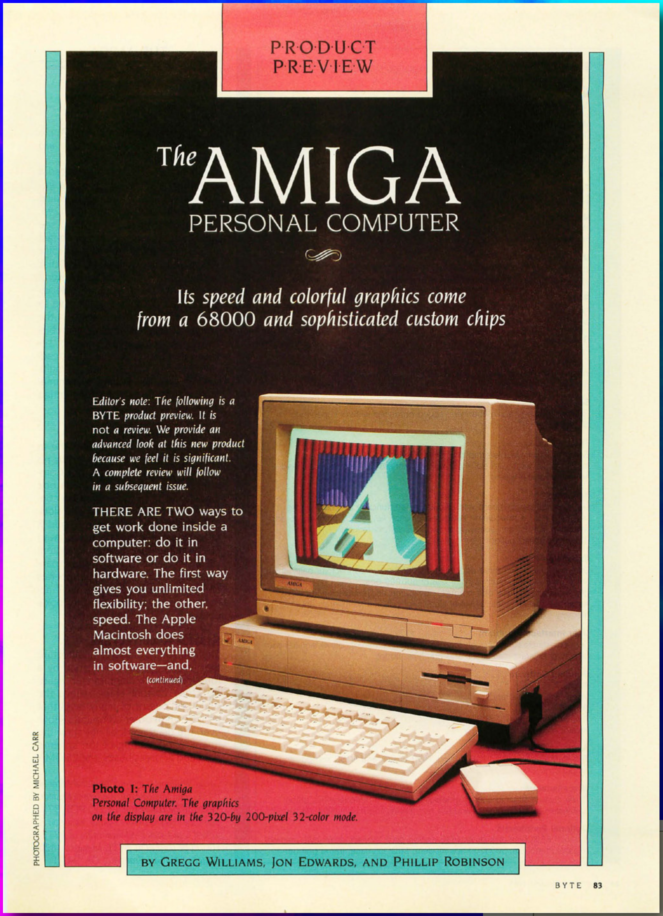
COMMODORE'S ANSWER to the Atari ST, the Amiga, looks like being the one machine everyone will want to own — if they can afford it. Like the ST the Amiga is built around the 68000 processor and has a Macintosh style operating system — written by UK company Metacompo — with icons and windows under mouse control.

Unlike its rival the Amiga is multitasking — it can run more than one program at once. But it is the machine's graphics facility that puts the opposition in the shade. A graphics chip coupled to a high speed bit image manipulator, a blitter, allows the Amiga to draw, shift and transform shapes on screen at a much faster rate than it could with the processor alone.

You can animate figures with just a few lines of code. There are two different types of sprites and a high resolution of 600x200 with 16 colours. The graphics chip is one of the three custom chips that make all the difference to the Amiga. They also give it a very sophisticated sound capability over four channels.

The stock machine comes with a 880K 3.5in. disc drive, 128K Rom and 256K Ram expandable to 512K. When it arrives in this country it could cost as much as £1,250. On top of this owners will need to spend at least £300 more on a high res colour monitor. At these prices you might expect forthcoming software to be mainly business applications. But the graphics potential is so great that software houses are said to be equally enthusiastic about writing games for the Amiga.

Enter the Amiga.



PRODUCT PREVIEW

The AMIGA
PERSONAL COMPUTER

Its speed and colorful graphics come from a 68000 and sophisticated custom chips

Editor's note: The following is a BYTE *product preview. It is* not *a review. We provide an advanced look at this new product because we feel it is significant. A complete review will follow in a subsequent issue.*

THERE ARE TWO ways to get work done inside a computer: do it in software or do it in hardware. The first way gives you unlimited flexibility; the other, speed. The Apple Macintosh does almost everything in software—and,

(continued)

Photo 1: *The Amiga Personal Computer. The graphics on the display are in the 320-by 200-pixel 32-color mode.*

BY GREGG WILLIAMS, JON EDWARDS, AND PHILLIP ROBINSON

PHOTOGRAPHED BY MICHAEL CARR

BYTE 83

The press adored the Amiga. *Byte* wrote a comprehensive review that concluded, “We were impressed by the Amiga’s detail and speed of the color graphics and by the quality of its sound system…we think this machine will be a great success.” *Compute* declared, “Perhaps the best thing about the Amiga is that it stretches our imaginations a bit further.” *Creative Computing* called the Amiga a “new communications medium–a dream machine…it can serve as the delivery vehicle for extremely sophisticated interactive experiences.”

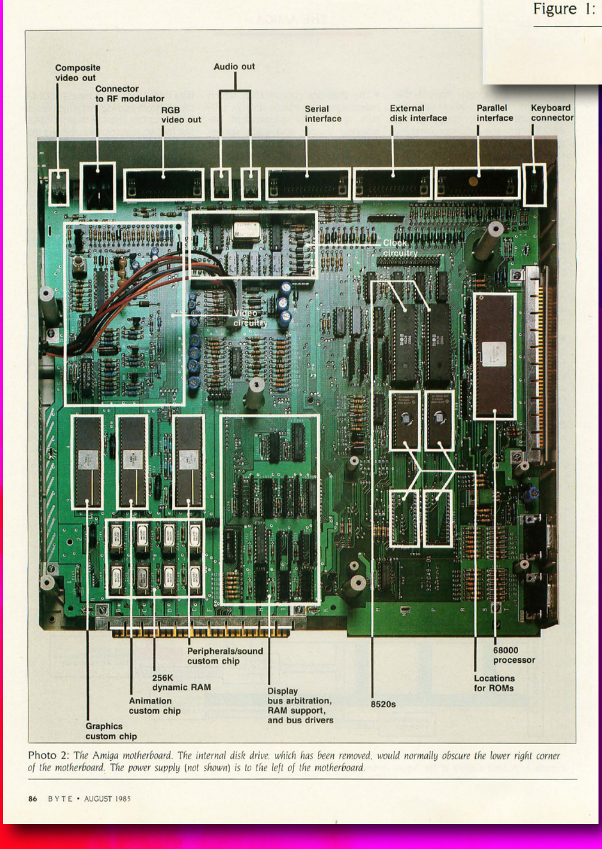


Photo 2: *The Amiga motherboard. The internal disk drive, which has been removed, would normally obscure the lower right corner of the motherboard. The power supply (not shown) is to the left of the motherboard.*

86 BYTE • AUGUST 1985

So how did Jay Miner, the Wizard of Amiga, manage this modern miracle? The solution was custom-designed chips, which were much cheaper to manufacture than circuits made up of off-the-shelf components. Miner was not new to custom-designed chips – in the mid-1970s he led the team that combined a number of the components in the design of the Atari 2600 into a single chip known as the Television Interface Adaptor, or TIA. The TIA aimed to remove the need for video RAM by rendering game objects directly to the television screen, one line at a time. This increased the complexity of programmed games, but greatly reduced the cost of the Atari 2600, placing those games in the hands of many more gamers.

Miner moved on to leading teams that designed two custom video chips for Atari’s subsequent home computer systems, known as the ANTIC or Alphanumeric Television Interface Controller chip, and the CTIA or Colour Television Interface Adaptor. The ANTIC chip could read directly from memory (without needing the CPU) and render multiple sizes of text to the screen as well as arbitrary graphical data, and provided CPU ‘interrupts’ that allowed software to execute drawing routines during the Vertical Blank Interval (VBI) at the end of a CRT’s raster scan while its electron gun was inactive.

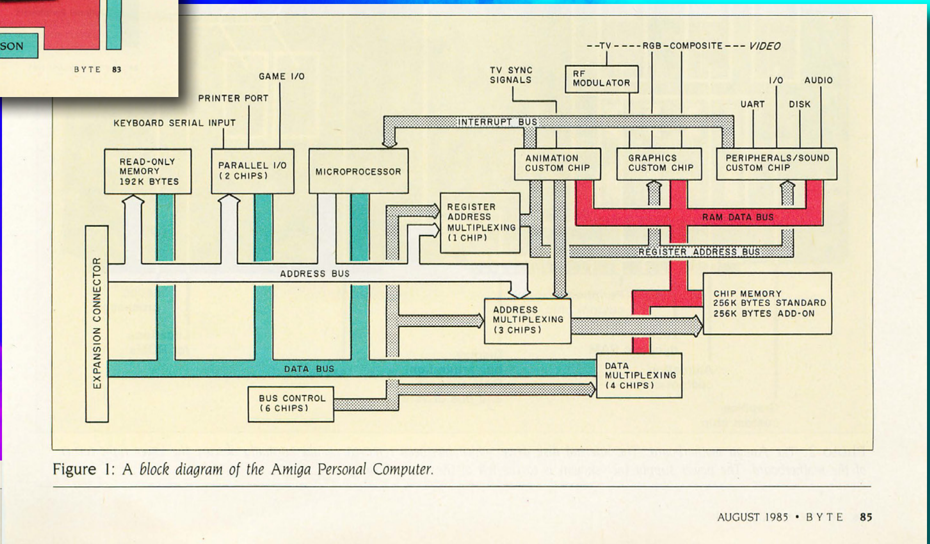


Figure 1: *A block diagram of the Amiga Personal Computer.*

AUGUST 1985 • BYTE 85

The ANTIC then sent the video information to the CTIA, which was based on the Atari 2600’s TIA chip and responsible for generating and colouring the video signal. The CTIA could also generate game objects on its own, known as Player/Missile Graphics like the TIA, but also like the TIA it had no memory, and so the ANTIC had to feed data to the CTIA line-by-line like Atari 2600 programmers had been forced to with the TIA. But combined the two chips provided powerful graphics capabilities (by 1979 standards) and helped make the Atari 800 (in particular) and later models successful.

Miner soon began to lobby Atari to start development of a 16-bit gaming console to succeed the Atari 2600 but Atari management felt a console version of the Atari 800 (to be known as the Atari 5200) would be sufficient for the foreseeable future. With nothing of consequence to achieve Miner left, taking a number of other engineers with him, and forming his own company, called Hi-Toro. This was a mostly amicable parting – Atari later provided half-a-million dollars in capital to keep Hi-Toro going, in exchange for first rights to whatever resulting chipset Hi-Toro created.

Hi-Toro then began work on what would become the Amiga.

The ensuing corporate shenanigans having already been adequately described in the 'fairy tale' that preceded this article, we won't waste time revisiting it, and instead focus on the technical aspects of Miner's eventual creation.

The heart of the Amiga was and had always been the Motorola 68000 processor – it was the catalyst for Miner to want to develop a 16-bit system in the first place. First released in 1979 it was a nerd's dream – although 16-bit externally, it was 32-bit internally which meant it could do incredibly complex operations at a much faster speed than contemporary 8-bit processors. However, that performance came at a price that was too high at that time for a mass-produced consumer product based on it to be practical – which is why Atari turned Miner's proposal down.

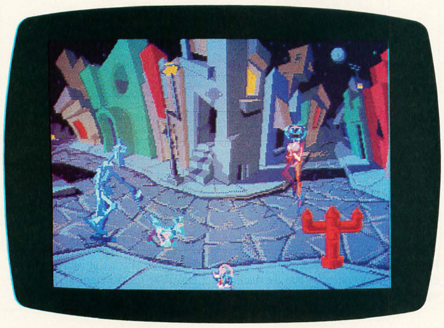


Photo 3: *Robocity, an example of Amiga graphics in the 320- by 200-pixel 32-color mode.*

But Miner realised that by the time all of the associated hardware and operating system software had been developed the price of the 68000 was likely to have come down within the required price range for a consumer product to be profitable, and he was willing to bet his own future on it. During that time, his company would need to develop three chips: a memory controller, dubbed Agnus, a graphics processor known as Denise and an audio chip called Paula. The functionality spread between them was similar to the functionality shared by the ANTIC, CTIA and 'POKEY' chips used in the Atari 8-bit computer line, the latter of which provided sound output, keyboard and game controller input.

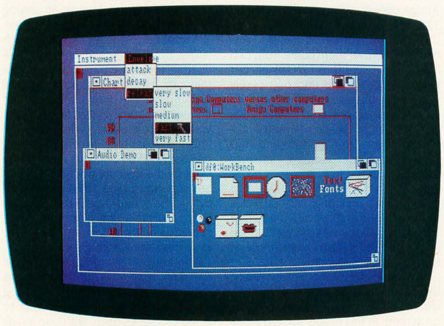


Photo 4: *The Workbench display. This is an example of the 640 by 200 mode.*

The Amiga's graphics were state-of-the-art. Its palette of 4096 colours was eight times larger than that of the Atari ST, and sixty-four times EGA's – and in its special 'HAM' mode, it could display all of those 4096 colours at once! (The ST and EGA PC could only display 16 at a time). The Amiga was even capable of 16 colors in 640x480 – a resolution that on the Atari ST was monochrome in the true sense (only black or white). You could even 'overscan all the way to 704x576 in PAL mode!

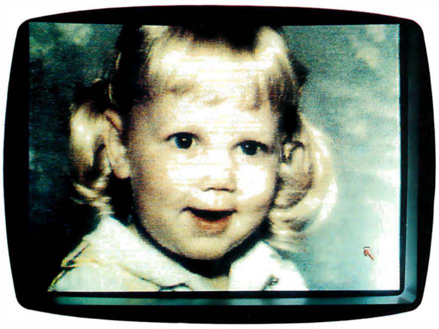


Photo 1: *A demonstration of the Amiga's hold and modify mode. (Data file courtesy of NewTek.)*

Of the three Amiga women, Agnus was the boss of the operation. All other chips, even the 68000, had to access the Amiga's memory through Agnus. This meant they couldn't attempt to write to memory at the same time – a problem known as write contention. Instead, they had to request accesses via Agnus, who was able to prioritise the requests and keep the overall system running smoothly.

But Agnus also had other roles pivotal to the Amiga's graphical capabilities. Firstly, she had a 'blitter', short for 'BLock Image TransferrER'. Agnus's blitter could rapidly copy large blocks of video memory without needing the CPU, such as when the user moved windows in the Graphical User Interface, or GUI. It could also fill areas of the screen with colour and draw lines. draw lines, either solid or using a repeating pattern.

```
Copyright © 1985 Commodore-Amiga,
All rights reserved.
Release 1.1

T-config v1.1
Copyright (c) 1985, 1986 by Tecna
All rights reserved

Friday 27-Jun-86  2:36:06pm

Making Lattice C assignments
Making Aztec C assignments
1> cd dh0:
1> aterm1.3
1> newcli
1> newcli
1> execute lca :source/sievel

Compiling :source/sievel.c
Lattice AMIGA 68000 C Compiler (Ph
Copyright (C) 1984 Lattice, Inc.
```

```
Getting Block 43...verified
Getting Block 44...verified
Getting Block 45...verified
Getting Block 46...verified
Getting Block 47...verified
Getting Block 48...verified
Getting Block 49...verified
Getting Block 50...verified
Getting Block 51...verified
```

```
/*    unsigned char r, g, b;        these ar

if (colors > MAXCOL)    /*color clipping*/
        colors = MAXCOL;
for (i=0; i<colors; i++)
        {
        any_cmap[i] =
                ((*cmap++ & 0xf0) << 4) +
        }
LoadRGB4( &PlopScreen->ViewPort, any_cmap,
}
```

Photo 2: *Multitasking on the Amiga.*

With Denise's spectacular capabilities, the Amiga won huge praise from the computing community, salivating over the potential for the Amiga to finally break computers into the media industry on a broad scale. With multitasking and digital sound thrown in, the Amiga seemed unstoppable – except for its operating system, known as Workbench. Like the Macintosh, Workbench was not included in ROM – early Amigas even had to load their DOS (known as Kickstart) from disk! This made 'booting' a bit of a chore.

Secondly, Agnus had the Copper. Short for 'co-processor', the Copper could execute a series of instructions in sync with the video hardware.

The Copper could be used to switch between video resolutions mid-frame, allowing programs to, for example, use a higher resolution for a menu bar, and a lower, more colourful resolution for the remainder of the screen.

Or, two programs could be shown on screen at once. Or change the colour palette each scanline, allowing for a different 16 (or 32) colours on each line. Or create rainbow 'raster bars' often used in games.

In order to improve the reliability of floppy disks, the original AmigaDOS stored additional redundancy data, which had to be processed on every disk read. While useful for floppies, it made hard disk usage on the Amiga much slower than with competitors.

Sheldon "The Ear" Leemon Appears on Jeopardy

Amiga Resource contributing editor Sheldon Leemon won second place on the April 19 episode of Jeopardy. His prize is a trip for two to the Bahamas.


Sheldon: Computers for $500.
Alex: The answer is: it's the slowest DOS for a 16-bit computer.


Sheldon: Aahhh . . . What's AmigaDOS?
Alex: That's right!

Finally, Agnus could synchronise the video timing to an external signal, which was important in the days of analog television as this was the only way you could 'mix' two video signals on the fly. This was known as 'genlocking'. The Amiga could also output video without a background signal, which meant it was easy to overlay Amiga graphics on top of video, and much more cheaply than conventional alternatives, which made it popular with television stations and studios.

Denise, meanwhile, had the job of rendering the graphics information she received from Agnus into an NTSC or PAL video signal, typically either 320 or 640 pixels per horizontal line, using a palette of 2-32 colours. This process is pretty straightforward, but Denise had a few tricks of her own. Firstly, she could display more pixels per line – known as 'overscan'– reaching the edges of a CRT display. Secondly, she could add an extra bit to each 5-bit 32-colour pixel which halved the brightness of the pixel if it was on – known as Extra Half-Brite (EHB) mode – effectively doubling the number of available colours to 64.

YOU'RE LOOKING AT
4,096 COLORS
4-CHANNEL STEREO
32 INSTRUMENTS
8 SPRITES
3-D ANIMATION
25 DMA CHANNELS
A BIT BLITTER
AND
A MALE AND FEMALE VOICE.

ONLY AMIGA GIVES YOU ALL THIS AND A 68000 PROCESSOR, TOO.

Three custom VLSI chips working in combination with the main processor give Amiga™ graphic dazzle, incredible musical ability and animation skill.

And they make Amiga the only computer with a multi-tasking operating system built into hardware.

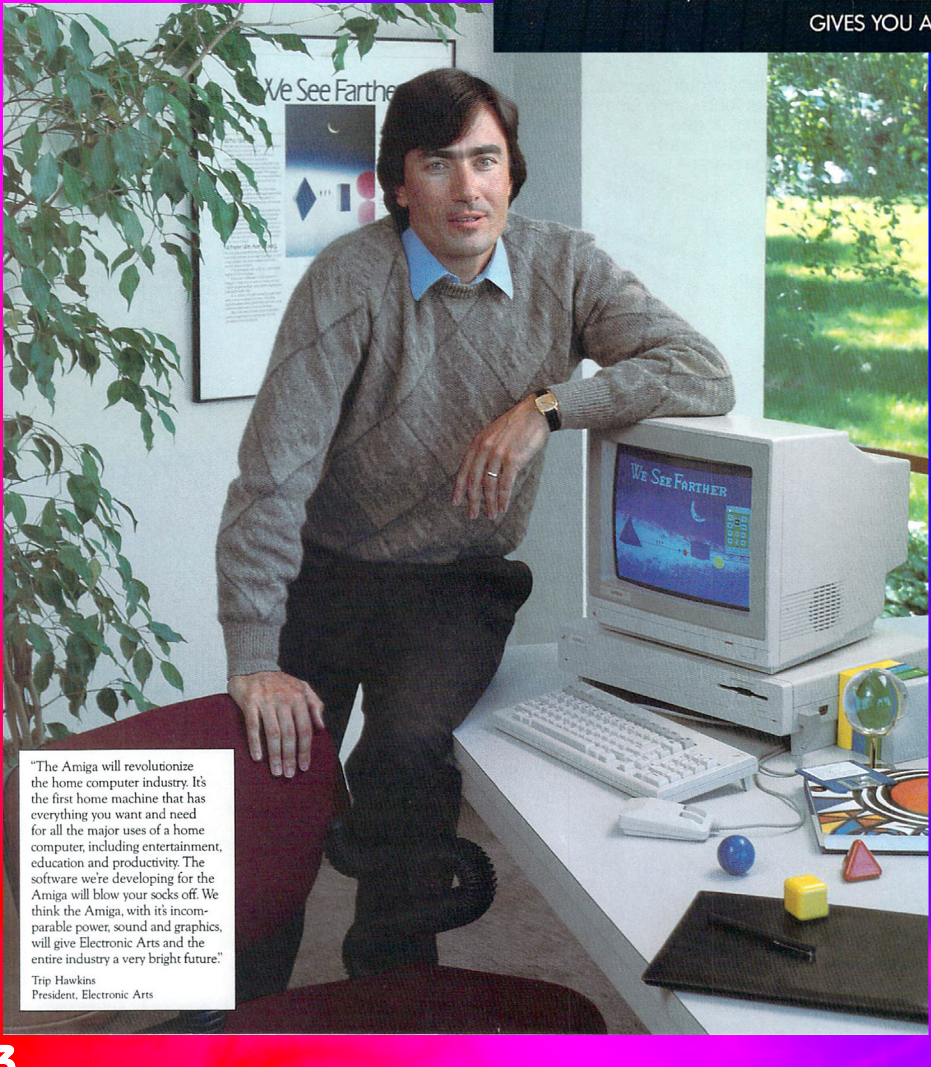
All these capabilities are easy to tap because Amiga's open architecture provides you with access to the 68000 main bus in addition to the serial, parallel and floppy disk connectors. Complete technical manuals enable you to take full advantage of the custom chips and the software support routines in the writable control store on the Kickstart™ disk that comes with every Amiga computer.

You can access these resources in a number of development languages, including Amiga Macro Assembler,™ Amiga C, Amiga Basic (Microsoft®—Basic for the Amiga), Amiga Pascal and even Amiga LISP.

So Amiga not only gives you more creativity, it gives you creative new ways to use it.

Amiga by Commodore.

GIVES YOU A CREATIVE EDGE.



"The Amiga will revolutionize the home computer industry. It's the first home machine that has everything you want and need for all the major uses of a home computer, including entertainment, education and productivity. The software we're developing for the Amiga will blow your socks off. We think the Amiga, with it's incomparable power, sound and graphics, will give Electronic Arts and the entire industry a very bright future."

Trip Hawkins
President, Electronic Arts

Thirdly, she could render graphics using 'hold-and-modify' or HAM mode, which rather than specifying each pixel from a palette of 16 colors, a block of six-bit pixel data could instead tell Denise to use the same colour as the last pixel, but modify either the red, green or blue component. Technically you could display all 4096 available colours, but in practice this required ensuring the 16 base colours you chose were appropriate for the image you were displaying. However, as the Copper was capable of changing the palette between scanlines, you could get around this limitation (known as 'sliced ham' or S-HAM mode, although this is less a mode and more of a technique.)

Fourthly, Denise could overlay one 8-colour screen on top of another; fifthly she could display 'interlaced' video that allowed for greater vertical resolutions than 200 pixels (although it didn't look awesome); sixthly she could manage up to 8 independent sprites and finally, Denise handled mouse and joystick input. Whew! Busy woman!

Last but not least, there was Paula. Paula was a true DJ: she spun disks, talked alot and made noise. On the first front, Paula was able to access connected disk drives much more directly than most contemporary floppy disk controllers – an entire track could be read or written at once, rather than sector-by-sector like on other computing platforms, increasing the amount of available space and correspondingly increasing the amount of data available on a normally-720K capacity disk to 830K or more. Because of the lack of abstraction between the controller and the disk, Paula could also read other disk formats, including that used by the IBM PC or Apple II.

On the second front, Paula managed the Amiga's serial port. But she didn't have a buffer, which meant that communications programs had to be careful to get every byte at the exact instant they arrived, otherwise Paula would forget it. On the plus side, Paula could send and recieve data as fast as it could be passed to her, meaning she could communicate at all standard bit rates and even some non-standard high-speed ones. But what Paula was really known for was her musical talents.

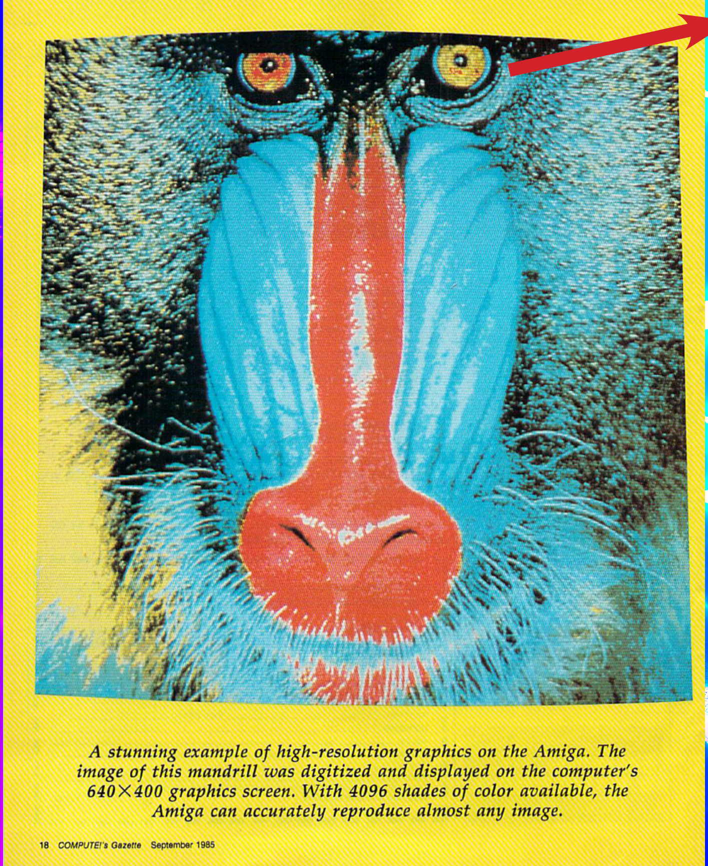
We'll get into the evolution of computer music in another article, but what you need to know right now is that while we now live in a world where we take digital sound reproduction for granted, this wasn't really the case in 1985. The compact disc had just been introduced and had achieved far from widespread adoption; virtually all other personal computers and videogame consoles made bleeps and bloops of varying complexity.

And so, Paula's four channels of digital sound – two routing to the left audio output and two to the right – were a novelty. To make things even better, Paula could play digital samples (via Agnus) from memory, and playback was even prioritised!

In 1988 the Fast File System was introduced that added a mode that didn't store the 'redundant' recovery information and significantly improved hard disk access times.

If you had an Amiga 1000 like those pictured you had to load the DOS (known as Kickstart) off of disk and could run the new FFS, but if you had an Amiga 500 with Kickstart in ROM you had to get a new ROM chip and install it in the computer, which required dismantling it! Being an Amiga user could be complicated.

This allowed for the use of 'lifelike' digital samples in games while requiring little effort from the CPU. But where Paula's abilities really came into play on the creative front was in the field of music, most notably through the software program known as Ultimate Soundtracker, Inspired by the Fairlight CMI sampling workstation's method of sequenced sample playback, Ultimate Soundtracker provided a straightforward way for composers (budding or professional) to harness Paula's four audio channels, and allowed the playback of realistic-sounding music. Later 'trackers' used software mixing to add more channels, but the Soundtracker 'MODule' format would reign supreme for some time.



A stunning example of high-resolution graphics on the Amiga. The image of this mandrill was digitized and displayed on the computer's 640×400 graphics screen. With 4096 shades of color available, the Amiga can accurately reproduce almost any image.

18 COMPUTE!'s Gazette September 1985

Together, Agnus, Denise and Paula made one formidable team! However, that team was not cheap, and at US$1285 for just the computer when it went on sale in August 1985 all many budding digital creatives could do was drool. And those that could afford it would have to wait – by October only 50 had actually been built, all of them testing or demonstration machines, and consumers wouldn't actually get their hands on them until mid-November, meaning many potential Amiga owners had moved on and purchased another 16-bit computer. such as an Atari ST.

This meant that by the end of the year Commodore had only sold 35,000 Amigas, causing it to run into cashflow problems and forcing it to miss the Consumer Electronics Show in January, 1986. To make matters worse, early models suffered from bugs, and the first cuts hit the marketing department, meaning the only thing driving sales was word-of-mouth, and that word was not always good.

Commodore's management realised the Amiga 1000 had a critical problem: despite its advanced chipset, the machine built around it didn't have sufficient specifications to appeal to the high-end creative market, while it was also too expensive for the average home user to casually purchase. And so they split the Amiga into two: the Amiga 500 and 2000.

The Amiga 500 was given a form-factor similar to the Atari ST, where the computer was built into the keyboard, and a 3.5 inch disk drive was placed into the side of the machine. The amount of memory was cut in half, from the 1MB of the Amiga 1000 to 512KB. Most importantly, the price of the 500 was US$699 – cut almost in half in comparison to the 1000, and making the 500 much more attractive to home users.

The 2000 meanwhile had internal expansion slots and space for a hard disk, a must-have for corporate users. This combination was a commercial success, and successive models of Amiga would follow a similar pattern of high-end and low-end variants. Ultimately, Commodore would reportedly sell around 5 million Amiga models, mostly in Europe and the UK.

But unfortunately, despite his success in turning the Amiga around, Commodore CEO Thomas Rattigan was forced out by majority shareholder Irving Gould (who had chased away Commodore founder Jack Tramiel years earlier). Development on the Amiga largely ceased, and its models were quickly overtaken in the market by technically superior competitors, such as Intel 386 and 486-based machines with VGA video hardware.

After a failed last-ditch effort to save itself by launching an Amiga-based videogame console, the CD32, in 1994 Commodore filed for bankruptcy. Its assets were purchased by German company Escom, which released a new model of Amiga with a better central-processing unit, but it wasn't enough at Escom too went bankdrupt in 1997. The Amiga's time in the personal computer limelight was over.

But the Amiga was not without its competitors…

Not to be outdone, Jack Tramiel's Atari Inc. launched its ST line of computers first, a few months ahead of the Amiga. While technically inferior in a number of ways, the "Jackintosh" was much cheaper when compared to the Amiga 1000, and featured hardware more similar to the arcade machines of the day, which made it attractive to casual computer users and gamers.

16-bit computing was an expensive proposition in the mid-1980s, with the available options costing nearly $2000 or more – sometimes much more. Jack Tramiel saw an opening in the bottom of the market for a 16-bit computer that offered basic features but provided a step-up for 8-bit computer users.

THERE'S ONLY ONE WORD FOR THESE PRICES: RIP-OFF.

Introducing the Atari 520ST personal computer system. $799

Go ahead. Compare those other machines with the new Atari 520ST.™ They cost hundreds of dollars more, but you don't get much in return. That's what we call a rip-off.

For $799.95,* the 520ST comes complete with high-resolution monochrome monitor, 2-button mouse, 3.5" disk drive, TOS™ Operating System, including GEM™ Desktop, plus Logo™ and Atari BASIC programming languages. $200 more gives you an RGB color monitor with 512 glowing colors.

Choose innovative business, entertainment, education, systems management, and integrated package software. Expand your 520ST with industry standard parallel printers, modems, MIDI controlled synthesizers and keyboards, 1 megabyte floppies, 10 MB and larger hard disks, and more. All available now. At remarkably low pr

So, go ahead. C to those other gu you so much. Fo

For the dealer Corp., Customer Ave., Sunnyvale,

	ATARI™ 520ST	IBM™ PCAT™	APPLE™ Macintosh™	COMMODORE™ AMIGA™
Price	$799	$4675	$2795	$1795
CPU Speed MHz	68000 8.0	80286 6.0	68000 7.83	68000 7.16
Standard RAM	512K	256K	512K	256K
Number of Keys	95	95	59	89
Mouse	Yes	No	Yes	Yes
Screen Resolution (Non-Interlaced Mode) Color Monochrome	 640 x 200 640 x 400	 640 x 200 720 x 350**	 None 512 x 342	 640 x 200*** 640 x 200***
Color Output	Yes	Optional	None	Yes
Number of Colors	512	16	None	4096
Disk Drive	3.5"	5.25"	3.5"	3.5"
Built-in Hard Disk (DMA) Port	Yes	Yes	No	No
MIDI Interface	Yes	No	No	No
No. of Sound Voices	3	1	4	4

**With optional monochrome board (non bit-mapped)
***Interlace Mode – 640 x 400

$799.95* With Monochrome Monitor

*Plus applicable local taxe
All prices are manufactur

Power wi

AMERICA WE BUILT IT FOR YOU
THE ATARI 520ST

"We promised. We delivered. With pride, determination, and good old ATARI know how."
Sam Tramiel, President, ATARI CORP.

No other computer we know of has been awaited with such anticipation, has received so much national and trade press, and has been so unanimously acclaimed — as the remarkable 520ST.

And for good reason. Its development represents a bold, new standard in personal computing power. The 520ST simply obsoletes all current personal systems — even those costing thousands of dollars more. Beneath its full stroke 94-key keyboard is an operating environment so intelligent that it puts you in command almost at once. It's that easy.

Graphic symbols quickly identify available functions. Menus appear just by aiming the mouse. Point to a specific operation, click the mouse and instantly you are able to develop full color charts, recall files from within folders, and so much more.

And when you combine 524,288 bytes of RAM with ATARI's custom circuits and the horsepower of a 68000 microprocessor, you own a powerful computer that delivers crisp, high resolution images with incredible speed.

With a monochrome monitor your 520ST displays 640 x 400 pixels of extremely high resolution clarity. Select a color monitor and you are able to create beautiful graphs and diagrams from a palette of 512 vivid colors.

Power to grow. An array of expansion ports allow you to easily customize your 520ST. There are standard serial and parallel interface ports for connecting printers and telecommunications equipment, MIDI connectors to interface with music synthesizers and keyboards, and 3.5 inch floppy disk, cartridge and joystick ports. There is also a hard disk port with the lightening communications speed of 1.33 Megabytes per second. ATARI 520ST systems are available now. *When it comes to state-of-the-art technology ...don't settle for less. And when it comes to price ...don't pay a penny more.*

For the dealer nearest you call 408/745-2367.
Or write to:
ATARI Corp.
Customer Service
1196 Borregas Ave.
Sunnyvale, CA 94086

The New ATARI®
Power Without the Price

$799.95
*plus state and local taxes where applicable.

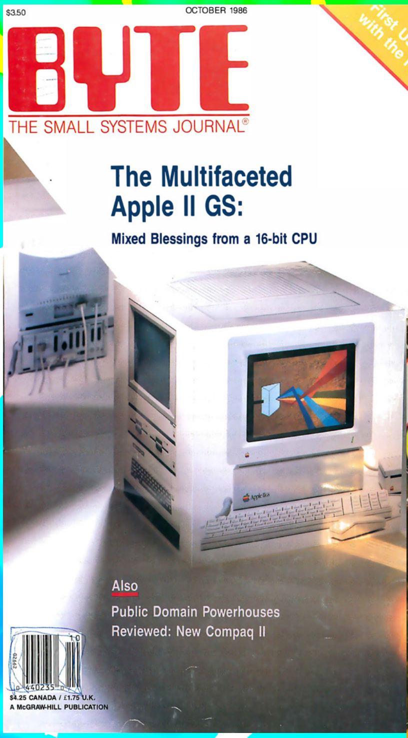
SYSTEM INCLUDES: 520ST Personal Computer, Monochrome Monitor, Mouse Controller, 3.5 inch Disk Drive, TOS™ - The Operating System Disk
ATARI Logo™ Language Disk
With full color monitor: $999.95*

Atari's advertisements emphasised the ST's cheaper price-point over its competitors, selling it as the budget alternative to the more expensive Amiga, IBM PC and Macintosh.

Like the Amiga and the Macintosh, the ST had a mouse and a graphical-user interface known as GEM, although it was incapable of multitasking. It only had a palette of 512 colours (in comparison to the Amiga's 4096) and only 16 could be displayed on screen at once in the lowest resolution (320x200) and only 4 at medium resolution (640x200). Using a proprietary Atari monochrome monitor, ST users could also use a high-resolution 640x400 video mode, which was primarily used by word processing, desktop publishing and music applications, the last of which leveraged the ST's built-in MIDI ports.

Derided as a videogame machine by Commodore, the ST found success amongst lower-income households, selling 50,000 units in the first four months of sales. It did particulary well in Europe, where exchange rates, taxes and profiteering made items like home computers much more expensive than elsewhere, and as such made the ST the only computer (and yes, videogame machine) many could afford.

The ST also had DOS and Macintosh emulators available for it, which made it attractive as a cheaper alternative for small businesses.

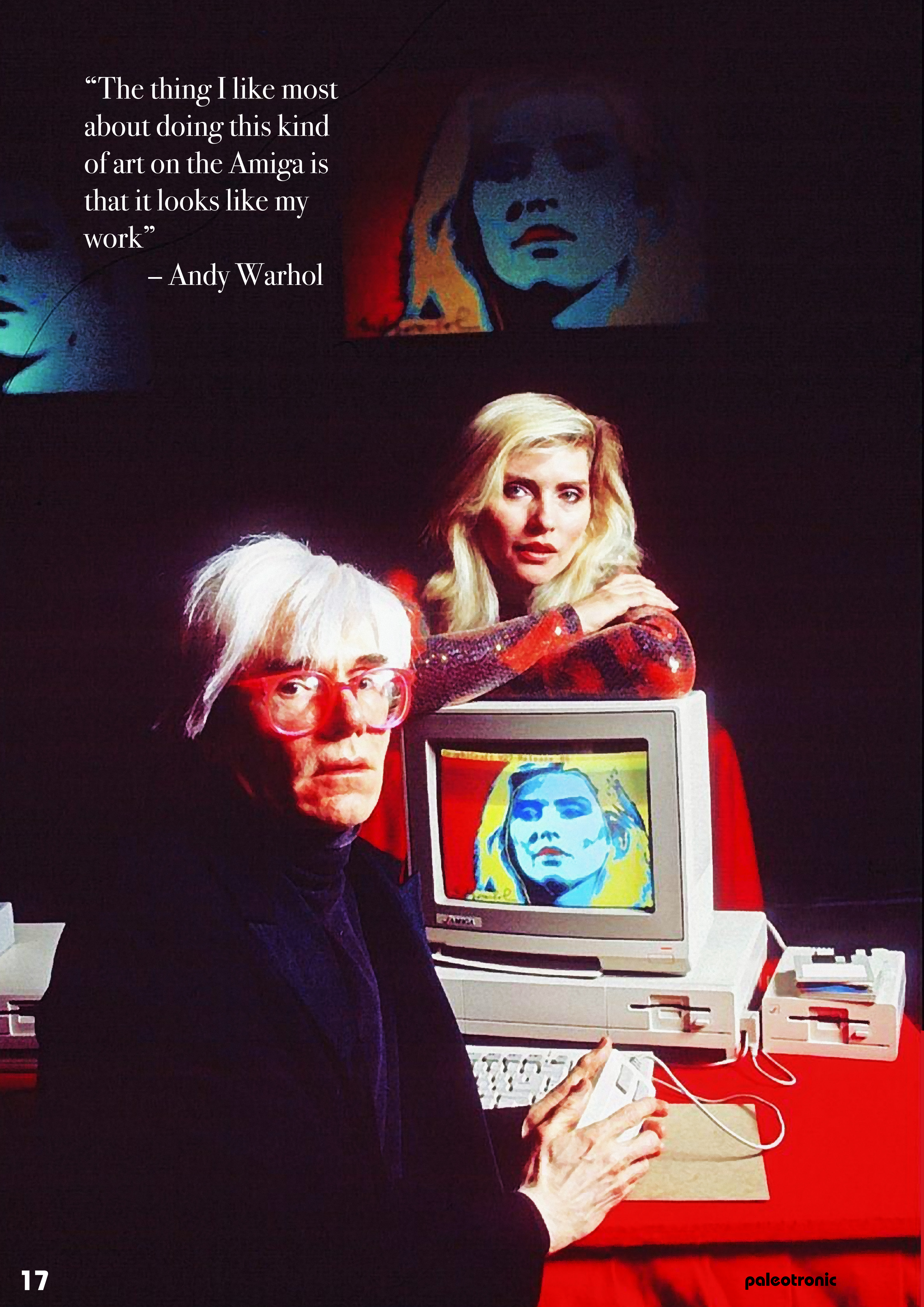


Apple also attempted to jump into the 16-bit home computer fray with its IIGS system. Backward compatible with the 8-bit Apple IIe it had the advantage of a lot of available software, but it was really late to the party, coming out in September 1986.

There is some disagreement over just how many units of the Amiga and the ST were sold. The rivalry between owners of the two has continued into the present day, with each side presenting figures that paint the other's sales unfavourably.

We can attempt to derive sales from the number of games available for each platform, but with estimates placing both at around 2000 that's not very helpful, although the similar numbers could be because it was worthwhile for software companies to "port" games from one platform to the other regardless of game sales made on either.

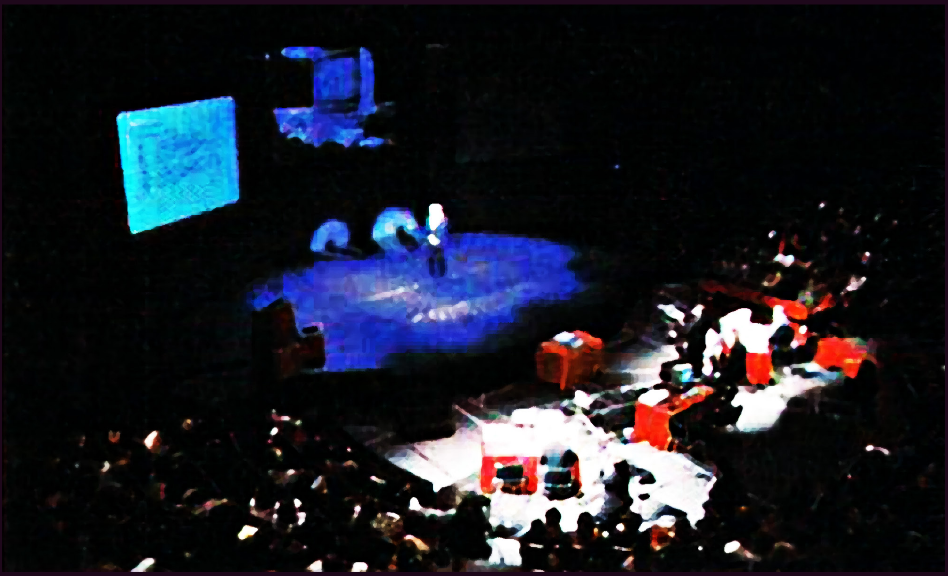
All we can say for sure is that the ST and Amiga were fierce competitors.



“The thing I like most about doing this kind of art on the Amiga is that it looks like my work”

– Andy Warhol

Who do you get when you want to impress the 1980s art world? Why, Andy Warhol, of course!



On July 23, 1985 at the Lincoln Centre in New York City, the Amiga debuted to a black-tie audience of press, software and hardware developers, Commodore shareholders, investors and celebrities.

The Amiga was presented as a bridge between technology and creativity, as a new kind of computer that could fill any need, be that artistic, or scientific, or business-related. A small company could get a single Amiga that would take care of all their computing tasks, or a large corporation could buy a fleet of them, each designated toward a particular purpose, but capable of taking over for any of the others should the need arise.

But while the Amiga could be argued as being a Jack-of-all-computing-trades, the evening in New York City was certainly more sharply focused on its creative abilities, as demonstrated on stage by pop-art sensation Andy Warhol, digitally painting musician Debbie Harry (aka Blondie).

The Amiga also showed off its musical skills, accompanying saxophonist Tom Scott in a live performance.

John Shirley, then-President of Microsoft was on hand to assure attendees his company would be supporting the Amiga by developing a new version of BASIC – although the 16-bit era would largely kill BASIC as a programming language, interpreters not generally being built-in, and BASIC compilers uncommon.

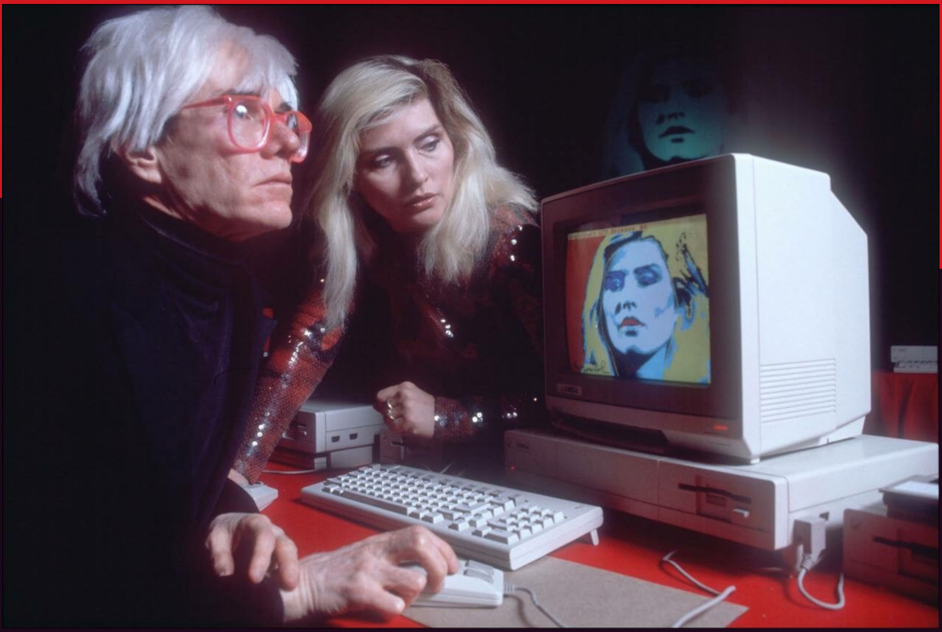
But the star of the show was the Amiga, displaying dazzling digital works of art and animation throughout the evening on three overhead screens. The Amiga even 'spoke' to the audience via speech synthesis, drawing applause.

Developers showed prototypes of their Amiga products while much discussion took place regarding the Amiga's future: what new applications would be discovered for it? How would it change the computing landscape going forward? What would its fortunes ultimately be?

Of course, we now know the answer to those questions, looking backward from our perch in the present, but that evening, as with many technology launches in the 1980s, the room was abuzz with speculation, hope and excitement for a future it was expected would be full of wonder and amazement.

And it was.

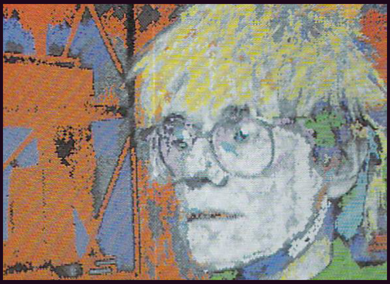
The Art Scene



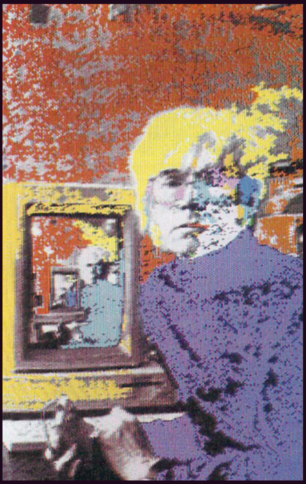
"(The Amiga launch) was like a museum, because we had a couple thousand people and I was working with (the Amiga) on the stage. It was like a museum because you could show your work."

"(My friends) all like it. They have been using the xerox, and they can't wait until they can use this, because there are so many people into xerox art...Jean-Michel Basquiat uses xerox. So, if he could be printing out on his own machine, he would be using this."

Warhol's technique used a black-and-white video camera, a still image from which would be captured and imported into the Amiga ProPaint paint program.



He created these self-portaits using that technique, while being interviewed by Amiga World magazine. The quotes presented here are also from that interview.



"I think someone like a decorator could use (the Amiga) when he wants to show somebody how their apartment would look all in blue or all in white, or...they could just do it easily. Change a chair or a colour."

"Well, I've been telling everyone about the machine, but they haven't been able to get one yet."

Attendees mingle at the Amiga launch event.

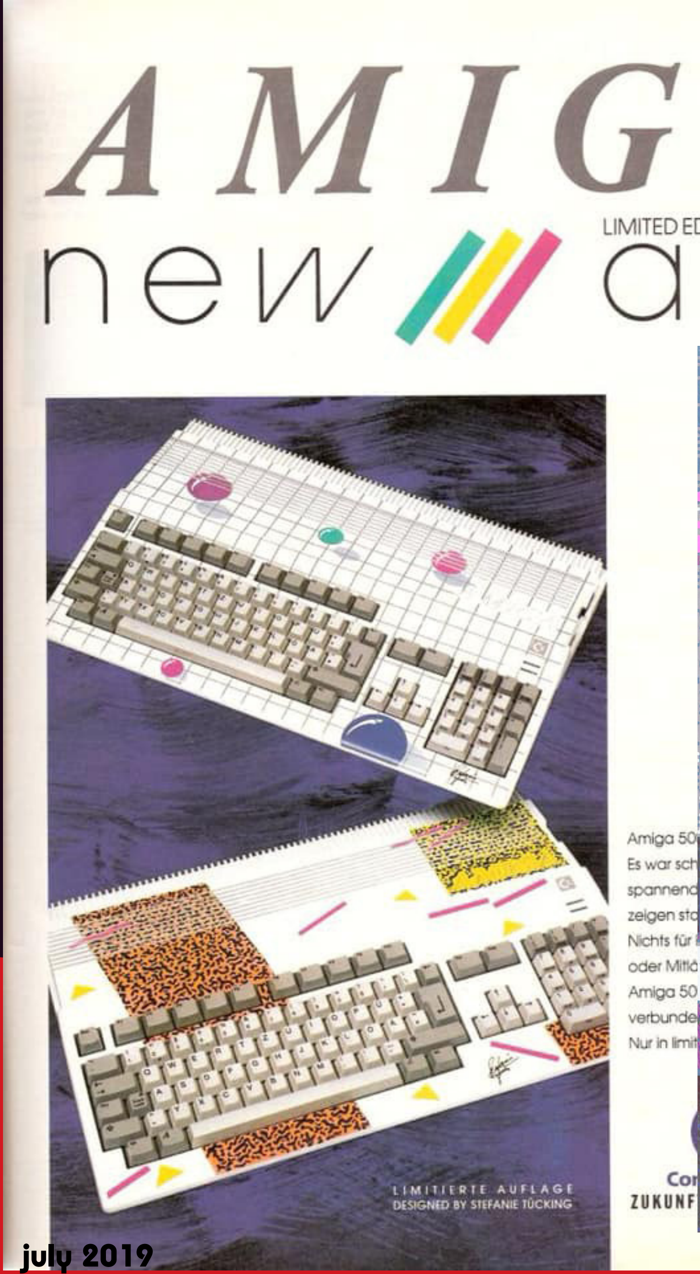
"I think (the Amiga) is great. It's quick and everything."

“Mass art *is* high art”

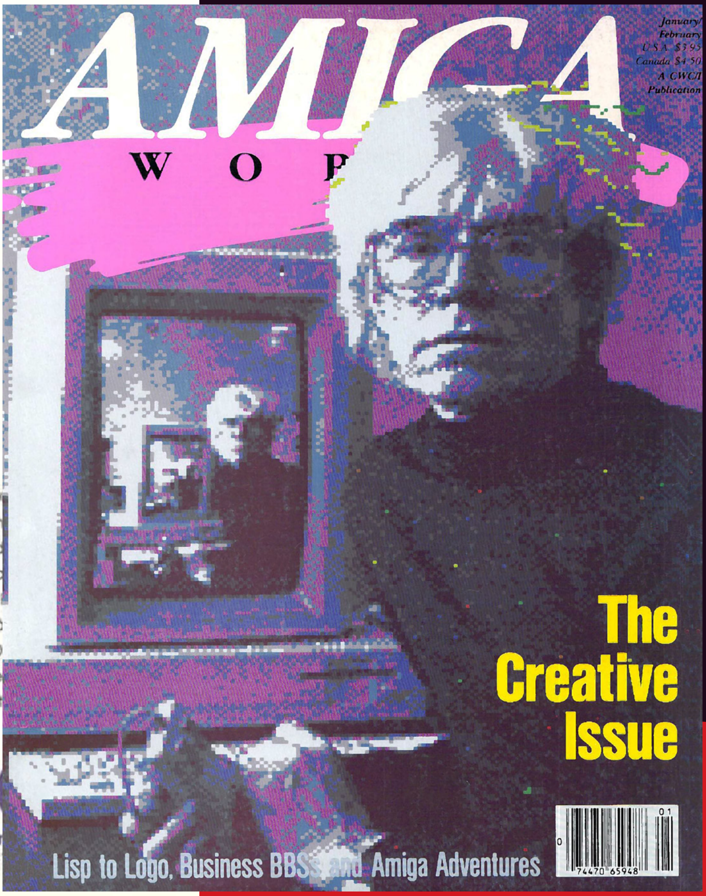
Andy Warhol was a champion of ‘pop art’: art created using imagery from popular and mass culture, such as advertising, products, comic books and other ‘mundane’ works. Pop art challenges the traditions of ‘fine art’ by attempting to capture modern life through the lens of commercial media, using irony and parody to make statements on both, while being critical of abstract impressionism.

“That’s the best part about (the Amiga). I guess you can… an artist can really do the whole thing. Actually, he can make a film with everything on it, music and sound and art…everything.”

These days we take this sort of thing for granted, but in 1985 the only way to do something like this was with paper or canvas and paint. The Amiga allowed for rapid iteration physical media just didn’t permit.



“(I) love the machine. I’ll move it over to my place, my own studio. That way I’ll be able to do the colours. It’ll be really great, and if we can get a printer, I’ll do this portrait in four different colours…”



the ART class

VIDEO DISPLAYS

Computers didn't always come with screens.

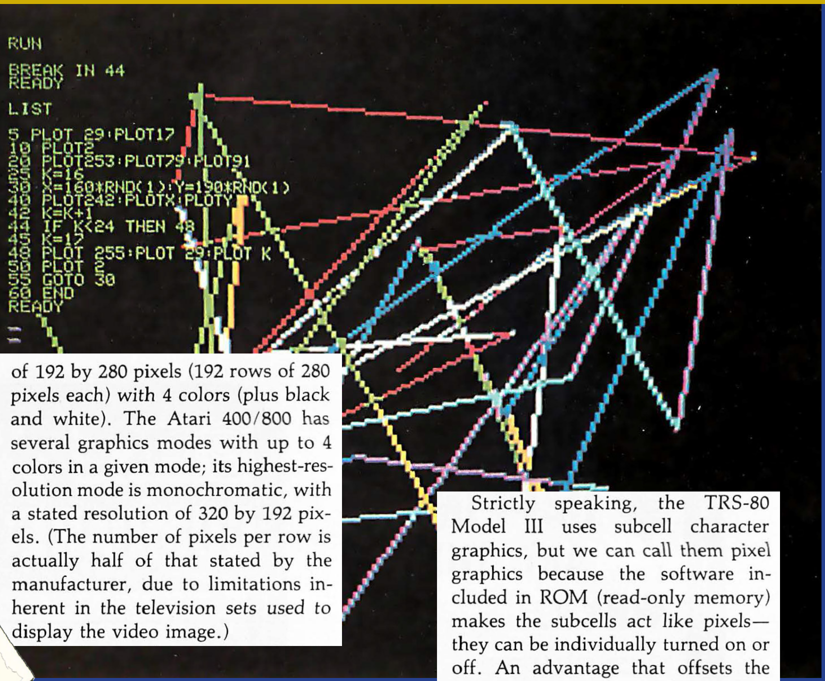
In the early days of computing, whatever output they produced was conveyed by LEDs or through paper printouts. But the first method was tedious (and often cryptic) and the second wasteful, and so the idea of using a CRT to display output was attractive. However, computer memory was expensive, and this limited early attempts at graphical displays to specialised CRTs that had 'persistent' output, similar to oscilloscopes. The computer would draw a line that would then fade over time, and if you wanted the line to continue to be visible after a certain point you would have to redraw it.

These were usually vector (line-based) displays, although some could display text characters by using magnets to direct the electron stream through a template positioned inside the CRT! Some had a simple buffer that could 'replay' a limited set of lines to keep them displayed on the screen.

But while these displays were better than blinking lights, they weren't very great for self-expression – at least not if that self-expression required more than about a dozen monochrome lines, or so.

Minicomputers were expensive and their owners could afford to spend thousands of dollars on a video interface. But the idea of a 'personal' computer created the need for much cheaper graphics hardware.

Different computers use different kinds of pixel graphics. The Apple II, for example, has two pixel graphics modes, called low-resolution and high-resolution (often abbreviated as LORES and HIRES). Although "low" and "high" are only relative terms, we should note that Apple II low-resolution graphics have 48 by 40 pixels (i.e., 48 rows of 40 pixels each) with 16 colors available; its high-resolution graphics have a stated resolution of 192 by 280 pixels (192 rows of 280 pixels each) with 4 colors (plus black and white). The Atari 400/800 has several graphics modes with up to 4 colors in a given mode; its highest-resolution mode is monochromatic, with a stated resolution of 320 by 192 pixels. (The number of pixels per row is actually half of that stated by the manufacturer, due to limitations inherent in the television sets used to display the video image.)



```
RUN

BREAK IN 44
READY

LIST

5 PLOT 29:PLOT17
10 PLOT2
20 PLOT253:PLOT79:PLOT91
25 K=16
30 X=160*RND(1):Y=190*RND(1)
40 PLOT242:PLOTX:PLOTY
42 K=K+1
44 IF K<24 THEN 48
45 K=17
48 PLOT 255:PLOT 29:PLOT K
50 PLOT 2
55 GOTO 30
60 END
READY
```

Strictly speaking, the TRS-80 Model III uses subcell character graphics, but we can call them pixel graphics because the software included in ROM (read-only memory) makes the subcells act like pixels—they can be individually turned on or off. An advantage that offsets the "coarse" graphics of the TRS-80 Model III is that the standard TRS-80 character set of letters, numbers, and symbols can be intermixed with the subcell character graphics. With most pixel graphics modes, on the other hand, you must build up alphanumeric characters by turning on individual pixels.

A number of approaches could be taken. The Apple II generated the NTSC video signal using the computer's ROM code, or built-in software, to save on costs. Other computers used their character generators to create simple graphics, still others custom chips.

Early displays for mainframe computers worked by having the computer direct the movement of the CRT's electron gun. These 'vector' displays provided for high-resolution graphics, but were impractical for multi-colour displays and text, and as memory became cheaper, pixel-based 'raster-scan' displays became possible. Although lower resolution, these were much more flexible.

Byte, November 1982

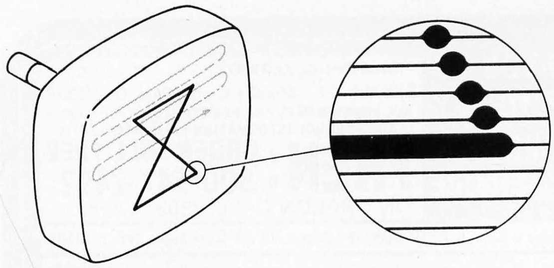


Figure 1: *A raster-scan image. In a raster-scan display, an electron beam is repeatedly swept across the video display tube in a series of horizontal lines, as shown by the arrow running back and forth across the face of the display (the dotted line indicates that the electron beam is turned off as it returns to the left margin of the display). By varying the intensity of the beam, the controlling electronics can create an arbitrary image on the display.*

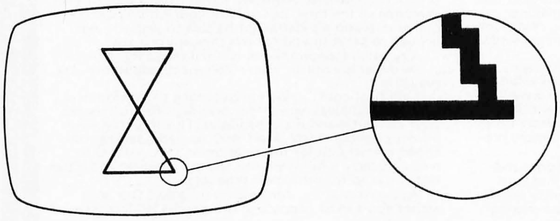


Figure 2: *A pixel image. Here, the video display is subdivided into a row-and-column array of square pixels (picture elements), which can be turned on to create an arbitrary image. Notice the "stair-step" effect on diagonal lines.*

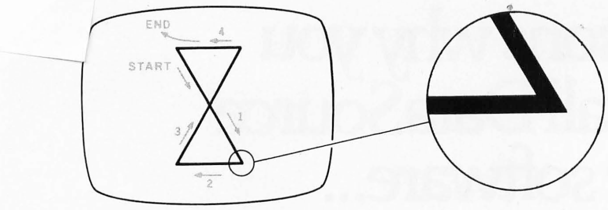


Figure 3: *A vector image. Here, the electron beam does not trace out closely spaced parallel horizontal lines. Instead, the controlling electronics move the electron beam to directly paint the desired image onto the face of the video display tube. (The numbered arrows show the order in which the line segments of the image are drawn.) Notice the lack of "stair-steps" on diagonal lines.*

Although vector graphics are cool for games like Asteroids and Battlezone, they weren't super-practical for home computer use. First, to display vector graphics you needed a special CRT, with magnets that could be controlled, whereas a typical CRT from a television set follows s particular pattern known as a 'raster', moving back and forth across the screen. Home computer owners typically connected their computer to their television set to save money.

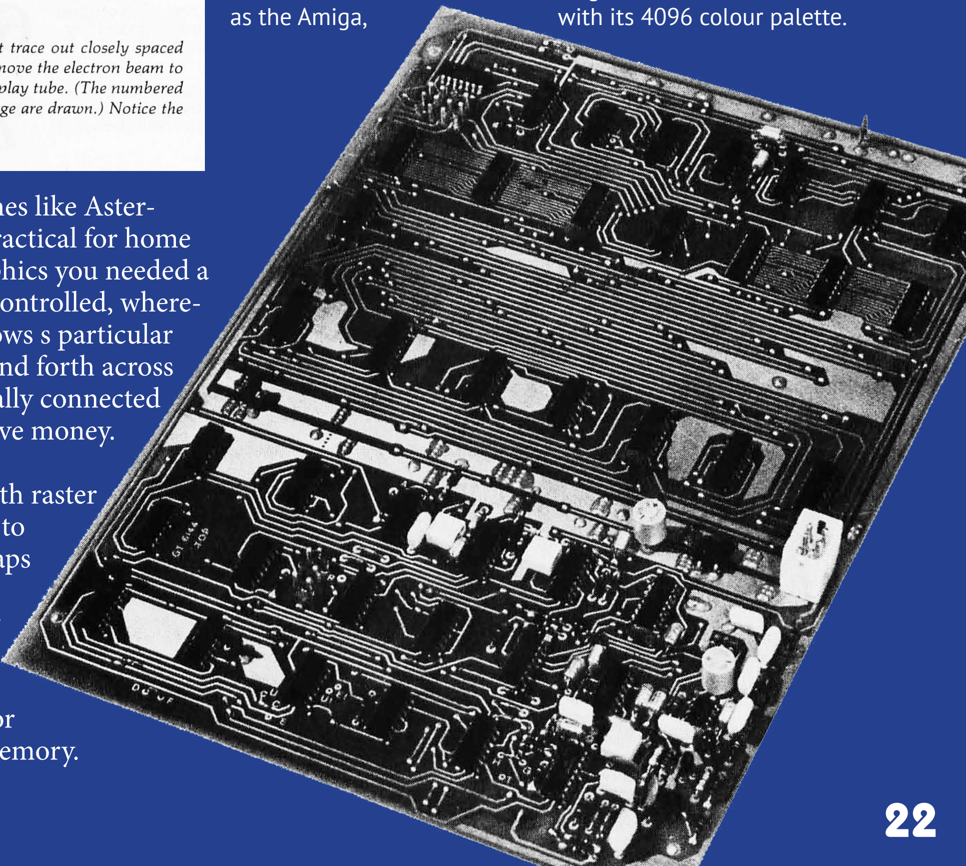
Second, you couldn't really display text with raster graphics, at least not text you would want to read in any quantity. And third, and perhaps most importantly to this article, the artwork potential of vector graphics is rather limited. The Spirograph-style graphics of Logo is cool and all, but we want to draw things, not lines! The solution was pixel (or raster) graphics. But this needed lots of memory.

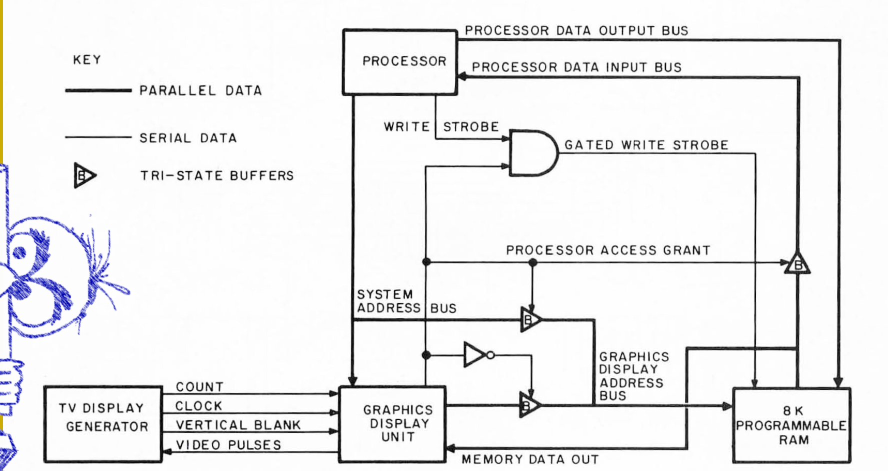
Pixel-based displays allowed for the creation of non-programmatic artwork – that is, artwork that didn't need to be reduced to computer code. The artist could 'paint' directly on the screen, using a mouse, light pen or even using the keyboard. This made digital artistic expression much easier.

Happily over time memory became cheaper, and after first going through a period of text-only 'terminals' (simple computers that displayed text using circuitry that generated individual characters, thus needing only as much memory as the number of characters displayed on the screen) it became cheap enough for 'bitmap' (or pixel-based) graphic storage (although some computers cheated a little and just allowed the user to redefine what some of the text characters looked like, a system known as 'character set graphics'.)

The Apple II was the first home computer with full bitmap graphics – and they were even in colour!

This became a must-have feature, and with large market demand it was only a decade between the introduction of low-resolution personal computers such as the Commodore PET and the TRS-80 Model I and high-resolution machines such as the Amiga, with its 4096 colour palette.





Apple II designer Steve Wozniak realised that by outputting various patterns of monochrome pixels, he could 'trick' the NTSC colour decoder in a television set or video monitor to display colours! But this came with certain restrictions: which colours you could use might depend on if the pixel was even or odd.

While the Apple II was the first home computer to come with bitmap graphics, owners of the Altair 8800 computer had been building video interfaces for a couple of years prior, and instructions had appeared in magazines. However, while the Apple II's built-in graphics removed the need to get out the soldering iron, they were still pretty limited: 16 colours at a resolution of 40x48, or 280x192 with 6 colours (and some pretty far-out artefacting!)

By not needing separate circuitry to generate the 'colorburst' signal, the Apple II could be manufactured more cheaply, while providing colour graphics. However, this reliance on the NTSC standard meant that users in PAL countries (such as Australia) would only see monochrome – which likely made the Apple II's rainbow logo a bit mystifying (or taunting!) for them.

Apple sold an add-on video card that provided a colour PAL output, but it added significantly to the overall price of the computer, and dampened its market impact outside of North America, where other computers such as the BBC Micro and the Sinclair Spectrum later stepped in. Apple eventually integrated PAL graphics into its IIe model.

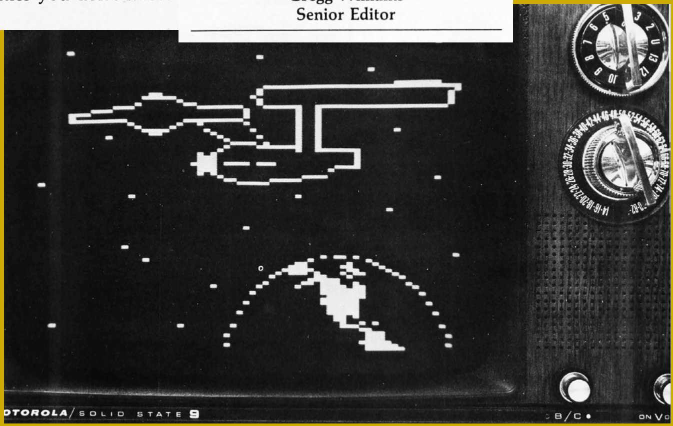
But the Apple II was state of the art and a very expensive computer (US$1298 or well over US$5000 today!) At US$550 the 1979 Atari 400 was much cheaper, and while it had a terrible membrane-style keyboard (imagine a keyboard made out of the 'buttons' used on budget Bluetooth speaker remotes) it had a 160x96 pixel display with 128 colours (you could draw some cool stuff with that!) It could also do 320x192 in monochrome. Up to that point, home computers targeted at the lower-end of the market had only had character set graphics, so this was an improvement.

Tandy responded a year later with the TRS-80 Color Computer. It was US$399 but while it displayed far fewer colours than the Atari it was cheap and often heavily discounted.

Computer graphics—those words conjure up images from movies like *TRON* and *Star Wars* or the sophisticated animation used in television ads. True, it took Nelson Max several seconds *per frame* of computation on a Cray I maxicomputer to create an animated film called *Carla's Island*. But that doesn't mean that you and your microcomputer are completely left out. Every arcade-like game you play on your microcomputer is an example of computer graphics, as is every pie chart created by a business-related program. In fact, it's possible that your microcomputer has picture-drawing capabilities you don't know about.

Gregg Williams
Senior Editor

Photo 6: *An X-Wing fighter done by Art Durinski at Information International Inc.'s now closed motion-picture division. (This image was created for the cover of IEEE Computer.) The successful simulation of the Star Wars spacecraft convinced George Lucas that scene simulation is an important special-effects tool.*



Science fiction movies and TV shows had initially inspired the imagination of the public regarding the potential of computer graphics, and as they evolved computers began to not only make those dreams come true, but started to create graphics for film and TV themselves. 'Futuristic' computer displays were then rendered by contemporary computers (although perhaps not in real time.) This evolution led to today's widespread use of CGI.

The home computer wars began in earnest after that, with companies such as Acorn and Sinclair in the UK coming out with color-capable computers in 1981 (BBC Micro) and 1982 (Spectrum) respectively; the BBC Micro featured a 640x256 8 colour graphics mode for a couple of hundred pounds. Texas Instruments released its TI99/4 computer, and Commodore came out with the VIC-20, which had some really strange video modes (176x184 pixels or 22 columns and 23 rows of text, making for very fat pixels and characters!)

The Commodore 64 was more conventional, with a 16-colour 320x200 pixel screen. Although the 64 had a true bitmap mode, it was very restrictive and most gane programmers still used character set graphics – but that wasn't too much of a problem because you could define up to 8 256 8x8 character 'sets' – you can draw pretty much anything with that!

In the mid-1980s the 8-bit era gave way to the 16-bit era, with computers such as the Commodore Amiga, the Atari ST and Apple IIGS providing high-resolution, multicolor bitmap modes and the resulting ability to create colourful, detailed digital artworks. High-end computer graphics workstations also began to appear for commercial use, such as the Silicon Graphics IRIS series, which was used to design graphics and visual effects for television programs and movies.

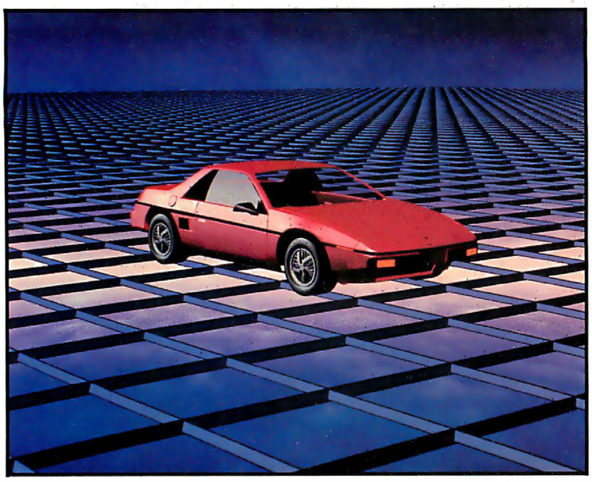
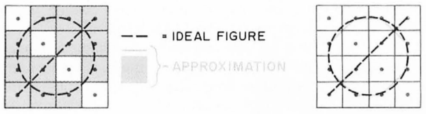


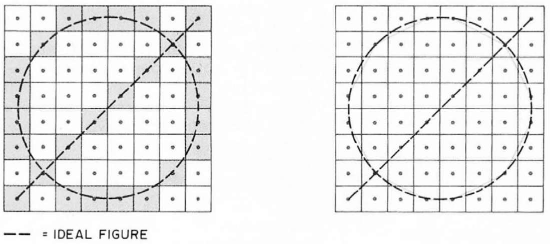
Photo 4: *Using the manufacturer's blueprints, the Cray at Digital Productions simulated this Pontiac Fiero, which assembles itself from pieces that fly in from all directions. Mario Kamberg and Jim Rygiel were the creative and technical directors, respectively. (Digital Scene Simulation (sm) by Digital Productions, Los Angeles, CA. ©1983, all rights reserved.)*

Sophisticated software was developed that allowed for the creation of scenes in three-dimensional space – a designer can specify a series of geometric shapes of varying size and position inside of that space, creating sophisticated 3D models. Initially, rendering these scenes to a screen could take a long time, but by the mid-1990s it was possible to render them fast enough to make 3D video game consoles such as the Nintendo 64 practical.

Figure 1: Raster Scan versus Analog Vector Graphics. For a given grid size and a figure covering a particular area (such as 4 by 4 or 8 by 8), the analog vector graphics method will give a better picture, where better is defined as a closer approximation of the figure desired.



a. Drawing a circle with a slant line through it is unrecognizable on a 4 by 4 grid of raster dots, but quite believable when drawn on a 4 by 4 vector graphics grid. A line drawing of the "ideal" circle with slash overlays the approximations for reference.



b. Drawing a circle with a slant line through it is a closer approximation on an 8 by 8 grid of raster splotches, but the 8 by 8 equivalent vector line drawing has a still closer approximation to the desired circle and line. A line drawing of the "ideal" circle with slash overlays the approximations for reference.

Pixelated graphics had serious disadvantages: rendering shapes at small sizes – a circle, for example, becomes a square. But increasing video resolutions effectively solved this problem – today's 'retina' displays have so many pixels it's hard to see anything so small affected by this issue. Modern video circuitry can also use vectors to render line-based graphics to raster displays, allowing that small circle to be zoomed in on with full quality.

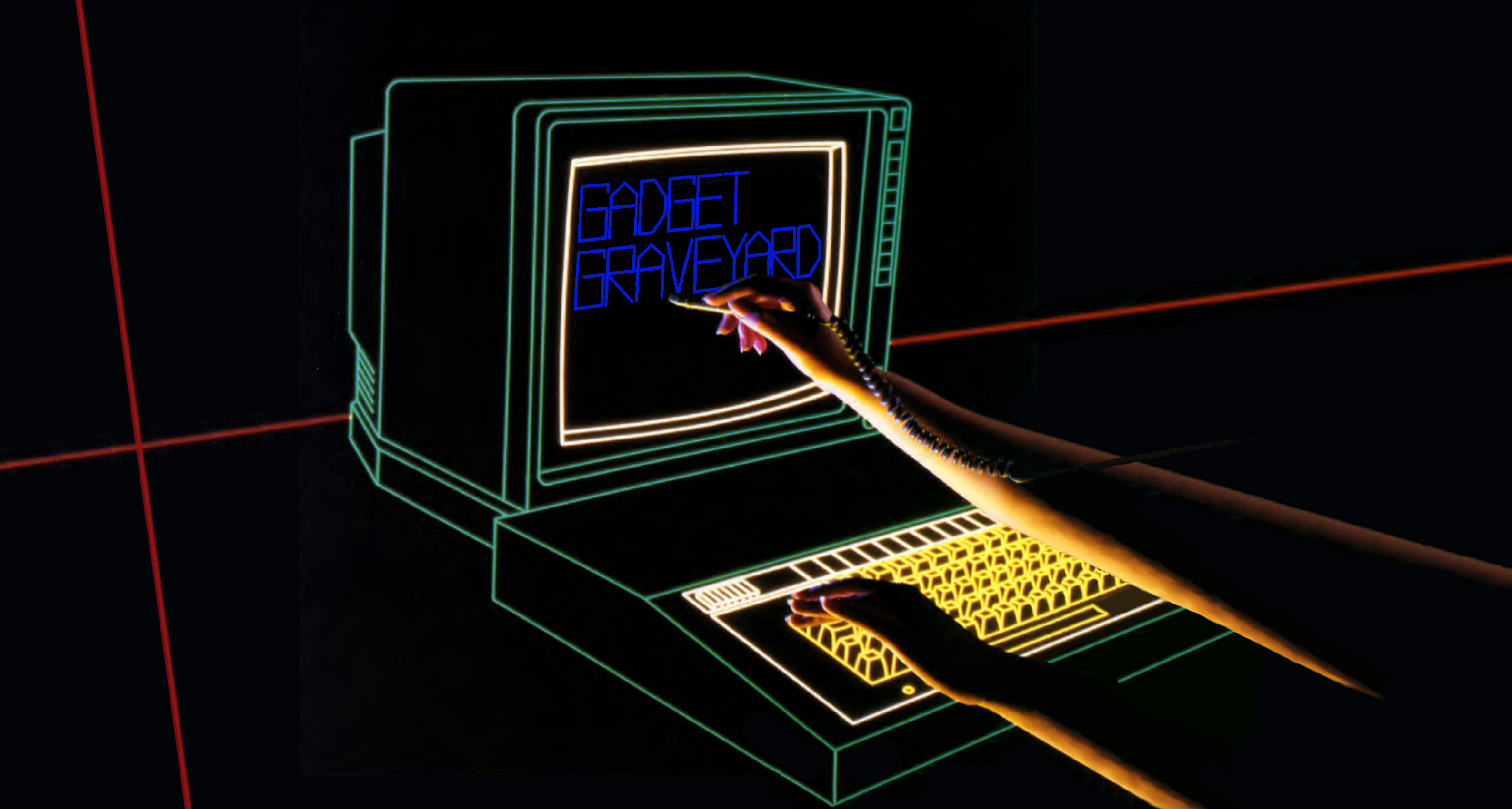
Modern computers can generate entire high-resolution 3D worlds, which can be explored in real-time.

But while computer graphics found a place in film and video professionally, it also allowed the amateur home user to express themselves without needing to make a mess, inhale smelly fumes or fork out for supplies. And if they didn't like what they created, they could simply decide not to save it.

This soon extended to writing and music as well, making the freedom to express ourselves digitally one we now take for granted.

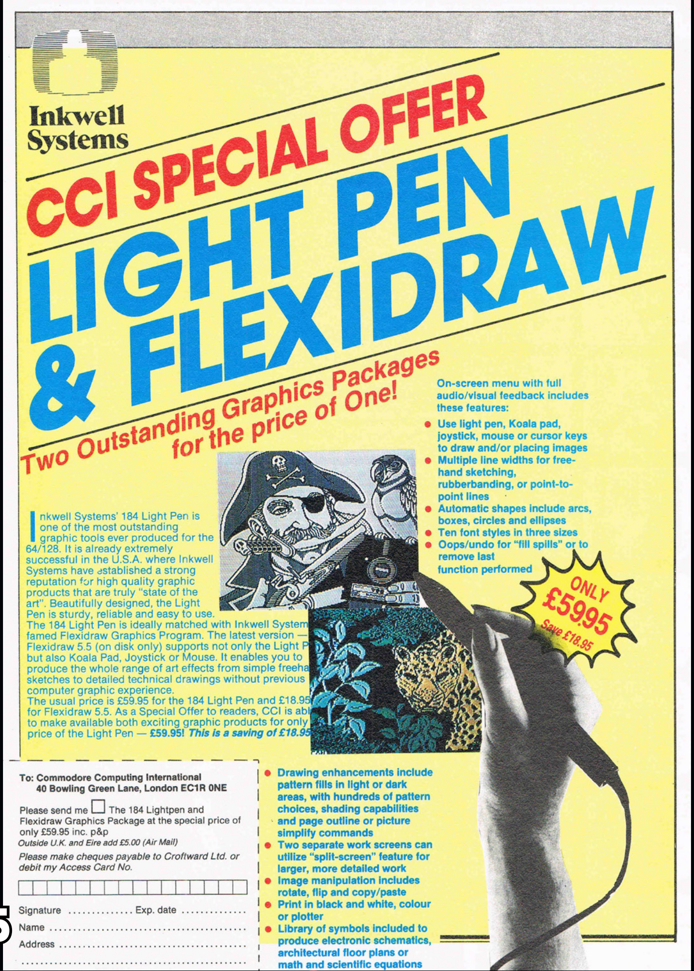
But these dream worlds wouldn't have existed were it not for the efforts of those early pioneers who saw the potential of computer graphics to create them.

We thank you!



So, it’s 1983 and you’ve saved up and bought yourself a shiny new computer with state-of-the-art graphics capabilities, and you’re ready to become a digital Picasso. But then you realise the only way you can ‘draw’ on your computer’s screen is either programmatically (either via BASIC or Logo) or through a graphics application, which offers either the keyboard or joystick as methods of input, neither of which gives you anywhere near the freedom required to draw what you want in a timely and non-frustrating fashion. What do you do?

WELL, YOU COULD GET A LIGHT PEN.


Inkwell Systems

CCI SPECIAL OFFER

LIGHT PEN & FLEXIDRAW

Two Outstanding Graphics Packages for the price of One!

Inkwell Systems’ 184 Light Pen is one of the most outstanding graphic tools ever produced for the 64/128. It is already extremely successful in the U.S.A. where Inkwell Systems have established a strong reputation for high quality graphic products that are truly “state of the art”. Beautifully designed, the Light Pen is sturdy, reliable and easy to use.
The 184 Light Pen is ideally matched with Inkwell System famed Flexidraw Graphics Program. The latest version — Flexidraw 5.5 (on disk only) supports not only the Light P but also Koala Pad, Joystick or Mouse. It enables you to produce the whole range of art effects from simple freeha sketches to detailed technical drawings without previous computer graphic experience.
The usual price is £59.95 for the 184 Light Pen and £18.95 for Flexidraw 5.5. As a Special Offer to readers, CCI is abl to make available both exciting graphic products for only price of the Light Pen — **£59.95!** ***This is a saving of £18.95***

On-screen menu with full audio/visual feedback includes these features:

- **Use light pen, Koala pad, joystick, mouse or cursor keys to draw and/or placing images**
- **Multiple line widths for free-hand sketching, rubberbanding, or point-to-point lines**
- **Automatic shapes include arcs, boxes, circles and ellipses**
- **Ten font styles in three sizes**
- **Oops/undo for “fill spills” or to remove last function performed**

ONLY £59.95 Save £18.95

To: Commodore Computing International
40 Bowling Green Lane, London EC1R 0NE

Please send me ☐ The 184 Lightpen and Flexidraw Graphics Package at the special price of only £59.95 inc. p&p
Outside U.K. and Eire add £5.00 (Air Mail)

Please make cheques payable to Croftward Ltd. or debit my Access Card No.

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Signature .... Exp. date ....
Name ....
Address ....
....

- **Drawing enhancements include pattern fills in light or dark areas, with hundreds of pattern choices, shading capabilities and page outline or picture simplify commands**
- **Two separate work screens can utilize “split-screen” feature for larger, more detailed work**
- **Image manipulation includes rotate, flip and copy/paste**
- **Print in black and white, colour or plotter**
- **Library of symbols included to produce electronic schematics, architectural floor plans or math and scientific equations**

What the heck is a ‘light pen’? Glad you asked!

A light pen is an electronic device that senses when the electron gun inside of a cathode-ray tube (CRT)-based display sweeps past the location on the screen the light pen is pointing at. By calculating where the CRT is in its sweep relative to the top-left corner of the screen, the light pen can determine its location, and then it tells your computer software so it knows where to plot a pixel or activate a desired GUI control.

Actually, that’s not quite true – the light pen simply returns a voltage to the computer that increases or decreases relative to the amount of light that its photoelectric ‘eye’ is seeing. It’s up to the software inside the computer to decide at what level that voltage indicates the CRT gun is directly aimed at the light pen. And this is where we start running into trouble. Some CRTs are brighter than others. The contrast may make it easier or harder to determine just where the “bright spot” is – if the contrast is sharper it is easier to detect the pass of the electron gun where its bright but harder where it’s very dark. The ‘persistence’ of the phosphors on the interior of the screen can increase the area of the screen that will return the maximum voltage level as the electron gun sweeps past it, decreasing the accuracy of the pen. Different colours also have different brightness levels, which makes simple light pens much better suited to monochrome displays. If all you’re looking for is the ‘bright spot’, you’re in for a world of trouble.

You can mitigate many of these issues by taking a more sophisticated approach. If you measure the rise and fall of the brightness of the pixel the light pen is pointing at over a few frames of video (and hence a few passes of the electron gun), you can calculate when the electron gun passes that pixel, no matter how bright or dark it is. But this requires more complicated circuitry or software. Which meant a more

expensive computer, or a more expensive light pen.

If the light pen is doing the work then it can simply tell the computer when the spot it's pointing at is at its brightest, assuming the screen doesn't change while it's figuring that out, at which point it will need to figure it out again. When it does, it just increases the voltage on a line, sending a 1.

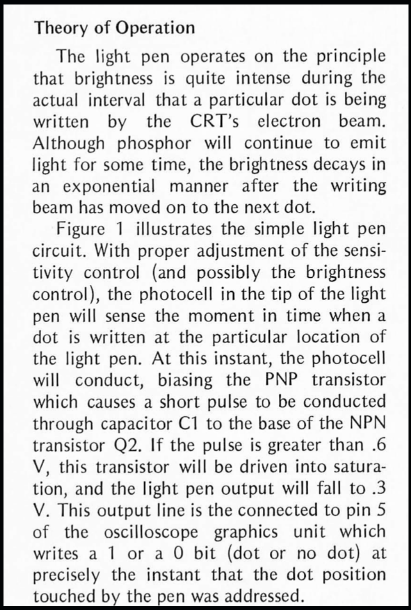
If the computer does the work, then it will be limited by the resolution of the data it can get from the light pen – on 8-bit computers connected via a joystick (really the paddle) port, this was usually limited to a single 8-bit number, that is, a number in the range 0 to 255.

This resolution could sometimes not be sufficient to detect the absolute peak of the luminance received, and the computer could calculate the position as too early, or too late, depending on if it relied on the start of the maximum input or the end of it. This could make the light pen's reported position inaccurate, and while not necessarily a problem for simple applications or drawing at low resolutions, high-resolution drawing could be difficult. Red or reddish pixels could make this even worse, as red phosphors took longer to decay, exacerbating the issue. But when they worked properly they were cool!

Light pens provided an alternative to common input methods of the time, such as the joystick or the keyboard, both of which were far too clunky to create fine detail in computer graphics without working at the pixel level – a time consuming process.

EDUMATE LIGHT PEN (FUTUREHOUSE)

> HOWEVER, AS COOL AS LIGHT PENS COULD BE, HOLDING THEM WAS TEDIOUS AND LONG-TERM USE WOULD RESULT IN "GORILLA ARM", A CONDITION CAUSED BY THE ARM MUSCLES REMAINING TENSE FOR EXTENDED PERIODS THAT MAKES THE ARM WEAK AND FINE MOTOR CONTROL DIFFICULT – RENDERING THE VALUE OF THE LIGHT PEN OVER ANY OTHER POINTING DEVICE LARGELY MOOT.



Theory of Operation

The light pen operates on the principle that brightness is quite intense during the actual interval that a particular dot is being written by the CRT's electron beam. Although phosphor will continue to emit light for some time, the brightness decays in an exponential manner after the writing beam has moved on to the next dot.

Figure 1 illustrates the simple light pen circuit. With proper adjustment of the sensitivity control (and possibly the brightness control), the photocell in the tip of the light pen will sense the moment in time when a dot is written at the particular location of the light pen. At this instant, the photocell will conduct, biasing the PNP transistor which causes a short pulse to be conducted through capacitor C1 to the base of the NPN transistor Q2. If the pulse is greater than .6 V, this transistor will be driven into saturation, and the light pen output will fall to .3 V. This output line is the connected to pin 5 of the oscilloscope graphics unit which writes a 1 or a 0 bit (dot or no dot) at precisely the instant that the dot position touched by the pen was addressed.

NEW HIGH RESOLUTION LIGHT PEN

INTRODUCTORY OFFER

NOT $100.00
NOT $ 29.95
BUT an Unbelievably LOW...
$19⁹⁵

At this low price, there's no reason to wait any longer to enjoy the full scope of computer graphics. The new Hoyt Light Pen is a high resolution, high quality instrument that enters information quickly and easily just by touching the screen. It's perfect for drawing, games, business graphics, design engineering, teaching, etc.

For all VIC 20®, Commodore 64® and Atari 400/800/1200®.

ORDERING: Phone orders 9 a.m. to 5 p.m. EST, Mon. thru. Fri. We accept money orders, personal checks (allow 2 to 3 weeks to clear), VISA and Mastercard charge orders to include card number and expiration date.

VIC 20 and Commodore 64 are trademarks of Commodore Electronics Ltd. Atari is a trademark of Atari Inc

30 DAY MONEY BACK GUARANTEE

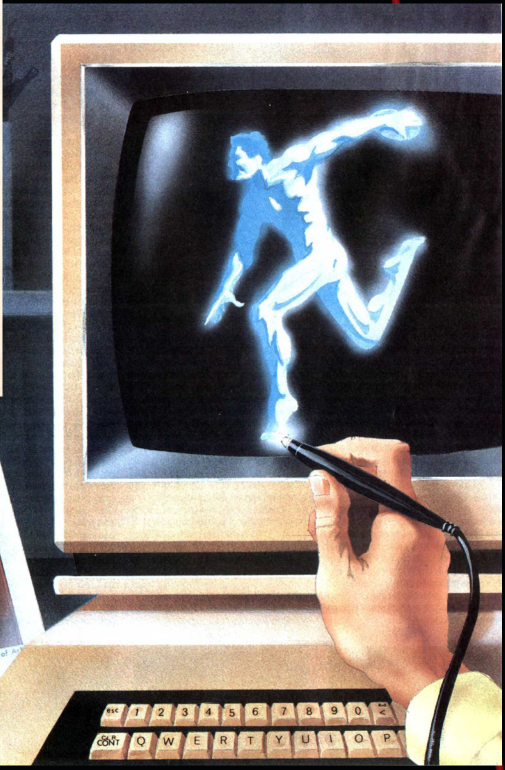
BUY BY MAIL!

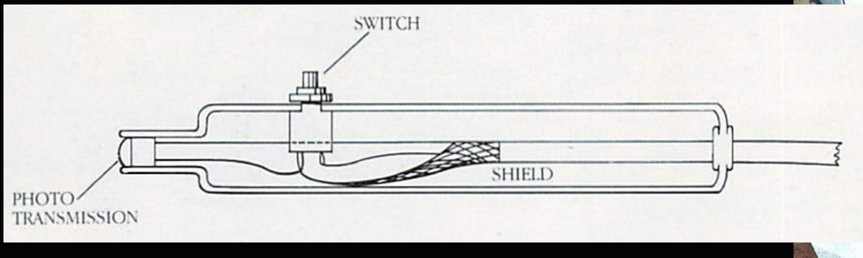
Add $1.50 for shipping, $3.00 for C.O.D. N.J. residents add 6% sales tax.

HOYT CORPORATION

Dealer Inquiries Invited
Hoyt Laboratories Division
520 South Dean St., Englewood, NJ 07631
201-894-0707
Over 60 years in business.

However, while the pens provided significant advantages over other methods, it was still far from perfect. If used as depicted below, your arm was likely to tire quickly. It was much easier of the surface of the display was horizontal, but doing this required specialised desks to mount the display in .

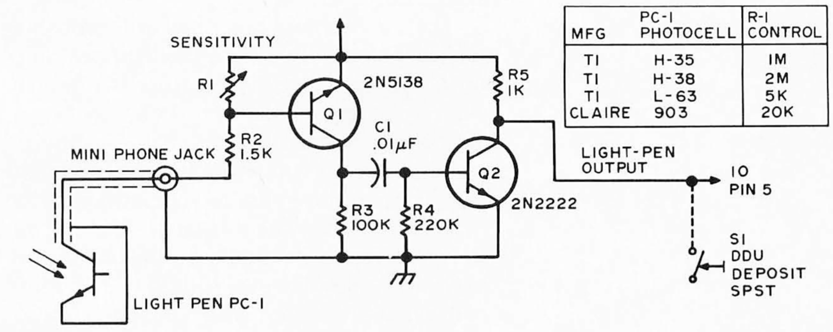




Since the mechanism behind the light pen could be extremely simplified, cheap versions enticed buyers. But they were often disappointed by their crudeness.

So, although your mileage could totally vary depending on your computer, the light pen you bought and the software you used, there was something futuristic about drawing directly on your computer screen, even if it wasn't terribly practical, and people were happy to give it a go despite the mixed reviews, especially if it was cheap.

In consequence, for most people, the light pen was something they used once or twice and then threw in a drawer and forgot about. But there were plenty of people (suckers) to sell them to!



MFG	PC-1 PHOTOCELL	R-1 CONTROL
TI	H-35	1M
TI	H-38	2M
TI	L-63	5K
CLAIRE	903	20K

Figure 1: The simple version of the light pen can be constructed according to this schematic. All resistors ¼ W.

Commodore 64

Computer Learning Pad

- **Makes Graphic Tablets Obsolete**
- **Includes Special Printer Feature**

Sale! $37.95 **Hi-Resolution!**

Now you get this **Fantastic Tech Sketch Computer Light Pen Program** with a **Professional Light Pen Free!** ($39.95 value) plus the **Micro Illustrated Graphics Pen Program** that allows you to draw on your T.V. or monitor screen (better than Gibsons $99 light pen). Whatever you can draw on the screen you can print on your printer (A Tech Sketch Exclusive.) (Disk) List $59.95 **Sale $37.95.**

Also available is **Lite Sprite**, a light pen driven sprite builder (List $39.95 **Sale $29.9**

Several plans for light pens were published in magazines, some more sophisticated than others. What they had in common was their mechanism: detecting the passing of the electron beam and then calculating the screen position based on the timing of that. But accuracy wildly varied.

The Light Pen at the Right Price:

THE LIGHT PEN

Shown actual size.

$34.95 Each

This is the **right** pen—a truly affordable peripheral. As an education aid to young children it is without equal, especially for pre-schoolers without keyboard skills. They simply touch the screen with the pen and a display is altered or new information is entered. Plus as an aid to games, it offers comparable utility to a joystick. Create your own programs with The Light Pen or choose from our software which includes a simple draw routine, checkers and hangman; or backgammon and chess. The Right Pen at the right price—maximum utility and minimum cost.

Prices subject to change without notice. See your local dealer or order direct. N
Add $3.00 for postage and handling. Credit card orders call toll

1-800-334-SC

DEALER INQUIRIES INVITE

programmer'sin

a division of **futurehous**

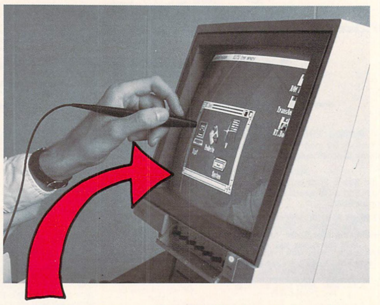
p.o. box 3470, dept. C, chapel hill, north carolina 27

As the resolution of graphics tablets improved, the number of creative or drafting professionals using even more sophisticated light pens decreased, and the market for light pens diminished into non-existence. Manufacturers stopped making them, advertising them or selling them. They were relegated to the past.

Eventually the end of the CRT monitor spelled the end of the light pen's usefulness full-stop, its dependence on the technology behind the CRT making them entirely incompatible with LCD and LED displays.

These days, you can draw on your iPad, a significantly improved experience.

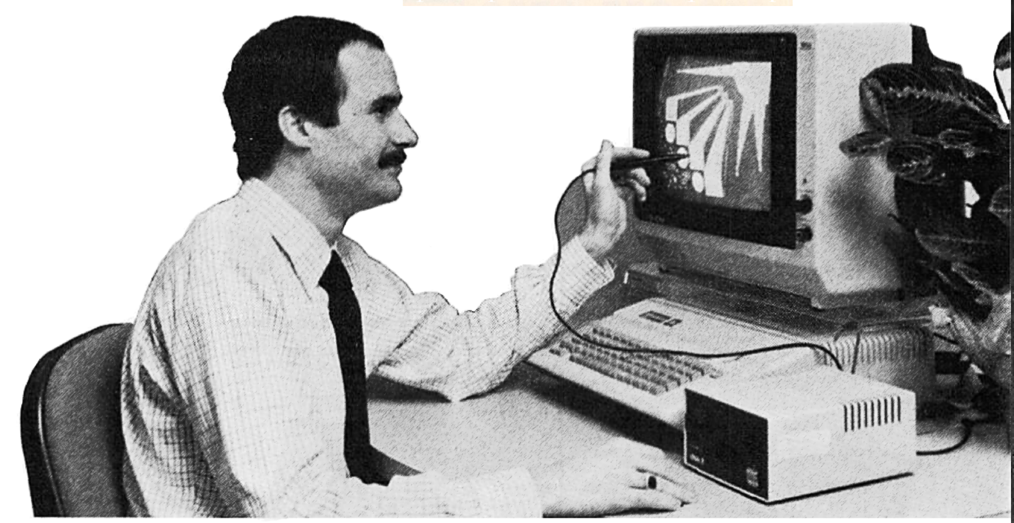
The consumer was unaware of this, however, only seeing rave reviews of typically more expensive light pens, along with advertisements for cheaper ones, and not considering there could be any significant difference. Some advertisements also implied the light pen could be used more universally than was actually possible.



For Best Results, Hold the Inkwell Light Pen about 2" from the screeN.

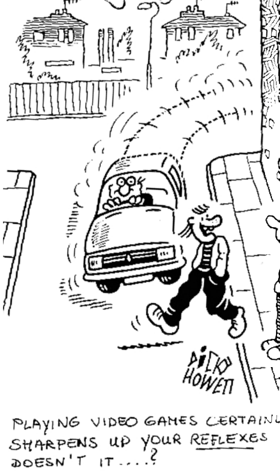
These users were often disappointed with their purchase. Word spread and sales dropped. Despite aggressive discounting, the light pen faded.

The light pen wasn't the only 'fad' peripheral a home computer user could end up with cluttering their drawers: there was also a text-to-speech craze that saw a number of models of speech (or vocoder) products (which were amusing for about ten minutes – unless you were blind, of course, which was the only group of users who actually needed that sort of thing.) Modems were also trendy, but high costs of online services quickly deterred users with more modest incomes. Hand scanners with poor resolution, thermal printers and cheap touch tablet round out the list.

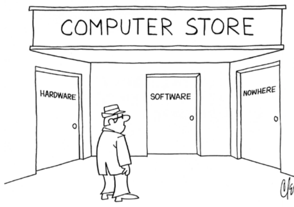


Steven Gibson demonstrates some of the graphics capabilities of his Gibson Light Pen system

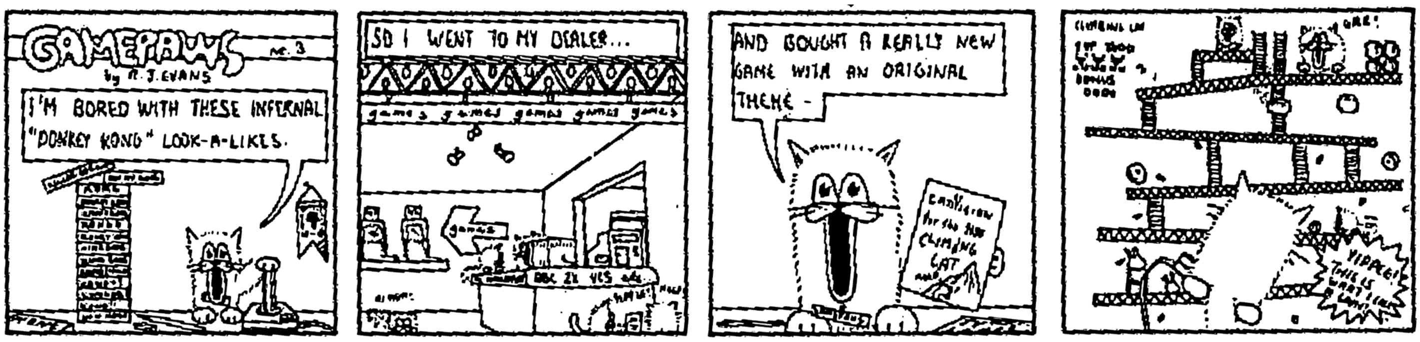
paleotronic's Pirate Booty



"Someday I'm going to pull a Gauguin; chuck all this, move to Newark and devote myself entirely to computer art."

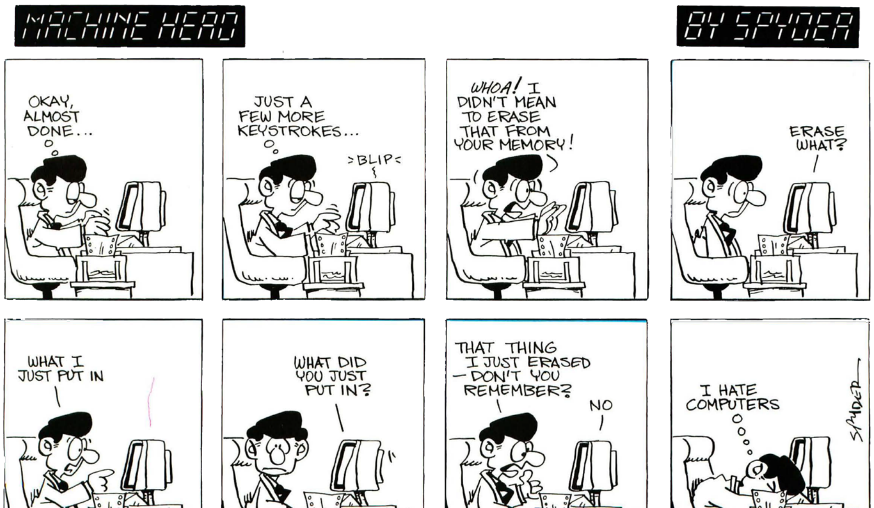


G-8 COMPUTE AUGUST 1993

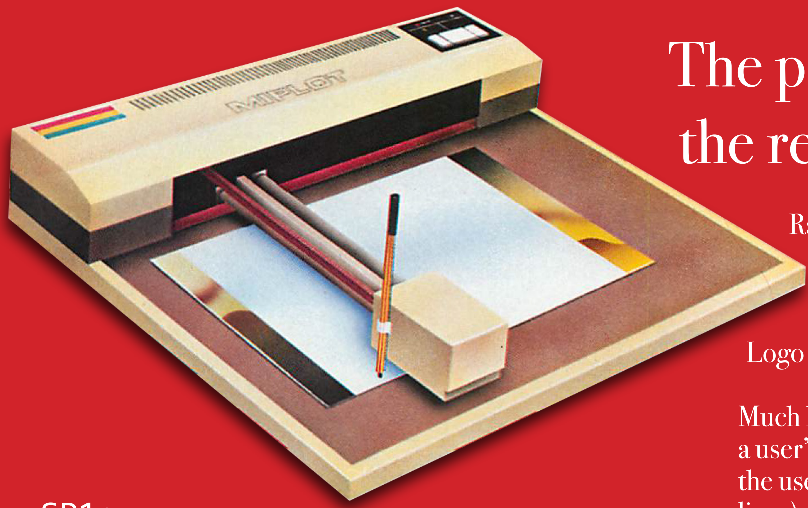


Bit Pit *Chas Andres*

CREATIVE COMPUTING



The pen-plotter was, in a way, the reverse of the light pen.



Rather than the user drawing on a screen, the computer drew on paper. However, instead of the raster-like back-and-forth of the dot-matrix printers, the plotter drew individual vectors, much like the turtle in the Logo programming language.

Much like a Logo program, rather than the computer storing a user's drawing as a flattened bitmap and modifying it as the user makes changes, the computer stores the vectors (or lines) that make up the user's drawing as the user is drawing it, rendering it to the screen sequentially whenever the drawing is loaded or the screen needs to be re-drawn.

On 8-bit computers this was much slower than simply storing a flattened bitmap, but had the benefit that pen plotters could accurately replicate the drawing without any pixelisation. The drawing was sent to the pen plotter using 'control languages' that looked a lot like Logo turtle commands:

```
SP1;
PA0,0;
PD;
PR0,1000;
PU;
PR1200,0;
PD;
PR0,-1000;
PU;
SP;
```

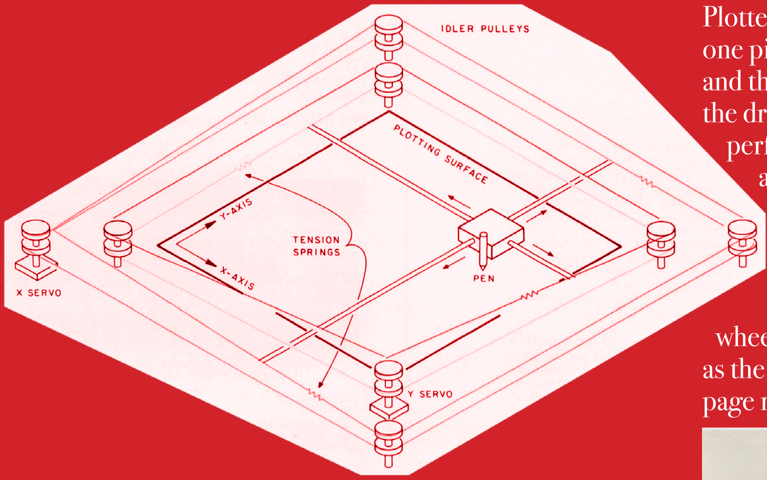
A simple pen-plotter program and its output, two vertical lines.

In the example to the left, the printer is instructed to take the first pen out of its 'stall' (SP1), move to the top-left corner (location 0,0) of the paper (in landscape orientation) (PA = Plot Absolute), put the pen to paper (PD = Pen Down), draw a vertical line 1000 units relative down (PR = Plot Relative to current position), then lift the pen up (PU), move 1200 units to the right, put the pen down again, draw a vertical line up the paper 1000 units, lift the pen up again, and then return the pen back to its stall (SP).

The result is a page with two vertical lines. Note that each command ends with a semicolon, so that the printer knows the command has finished and it can process it. These printers didn't have a lot of memory (neither RAM nor ROM) and so they had to be very economical with their programming languages! This particular plotting language was developed by Hewlett-Packard and was called HP-GL. Another language, from rival Houston Instruments, was called DMPL.


NEW LOW-COST ENGINEERING/BUSINESS PLOTTER

Computer users, however, didn't usually need to program the printers directly. They could use BASIC 'extensions' (additional commands added to built-in BASIC interpreters by loading a binary program after the computer was turned on). These extensions allowed them to control the printer using commands such as PLOT, PEN and SCALE, the latter able to translate pixel co-ordinates into printer co-ordinates (the printer usually having a much larger 'grid' from which to work with, in an era when most screens were less than 200 pixels wide, if they could even display pixels at all.)



Plotters came in a few different designs. Early plotters, like the one pictured directly below, wrapped the paper around a drum, and then moved the pen horizontally across the drum, rotating the drum in order to move vertically. Sometimes the paper had perforations, like 'tractor feed' paper for dot-matrix printers, although the model below appears to use electro-static charging to hold the paper in place. The model at the bottom of the page used friction rollers to keep the paper straight, and a roller behind to move it, while the plotter at the bottom of the opposite page used two tiny wheels, known as 'grit wheels' which created tiny indentations as the printer moved the sheet back and forth, ensuring the page remained straight.

However, the 'flatbed' plotter is the most recognisable style of pen-plotter. With a flatbed plotter, the paper remains stationary, and the pens are moved both vertically and horizontally by the means of two bars driven by pulleys and toothed belts or wires. Although it was the slowest of all the plotting methods (plotting was slow!), and pages had to be manually inserted and removed, users did not need to worry about the paper coming askew and ruining the drawing, or wrinkling or jamming.

Also, the flatbed plotter was much more suited to having multiple pen colours, the plotter directly below featuring 8 different pens.

Quality Low-Cost

Graphics

for your computer

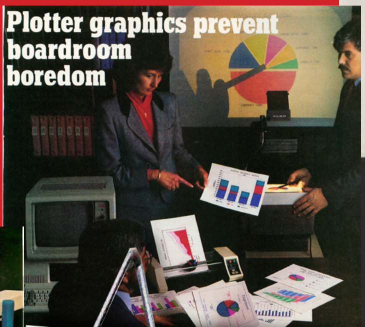
Expand your computer's capabilities with this easy-to-use drum plotter.
The Strobe Model 100 interfaces to any computer to generate professional quality graphics.

OFFERING High Resolution Graphics Output * Outstanding Performance * Assembler Coded Drivers for High Speed Plotting * Precise Operator Controls * Interactive Coordinate Input

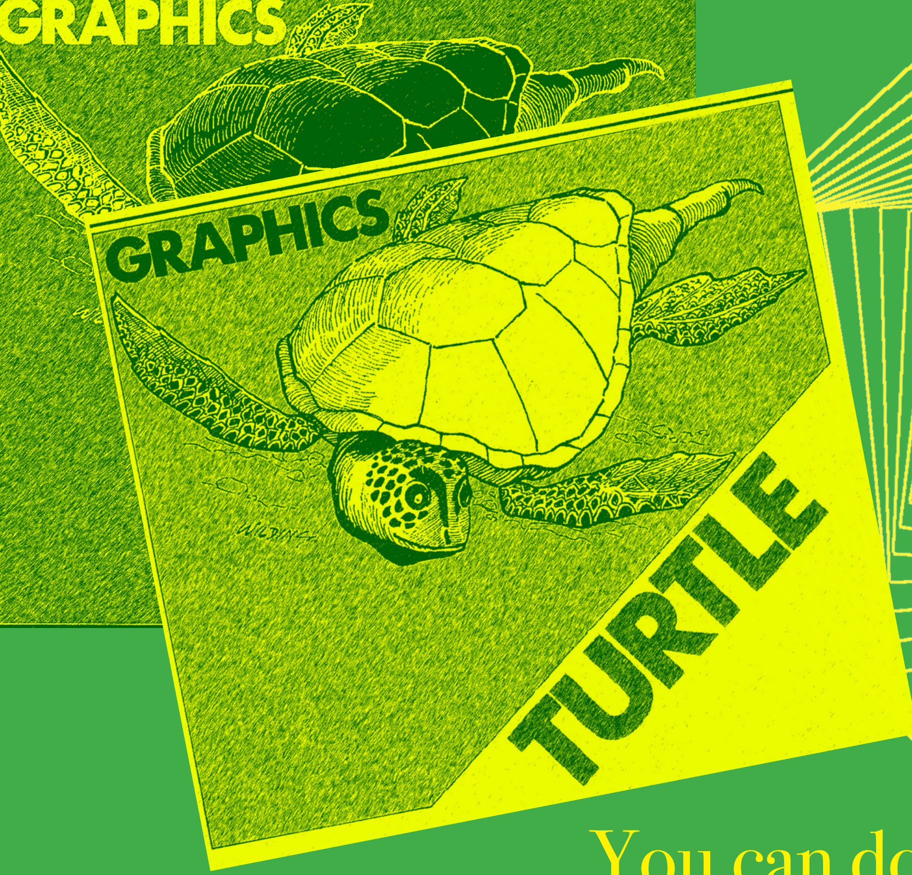
ALSO AVAILABLE Hardware Interfaces for — TRS-80 · APPLE II · PET · S-100. Applications Software Package providing graphing, vector plotting, and variable size alphanumerics for: TRS-80 Level II BASIC, Applesoft BASIC, CBM PET BASIC, Northstar BASIC, CBASIC, Microsoft BASIC & FORTRAN.

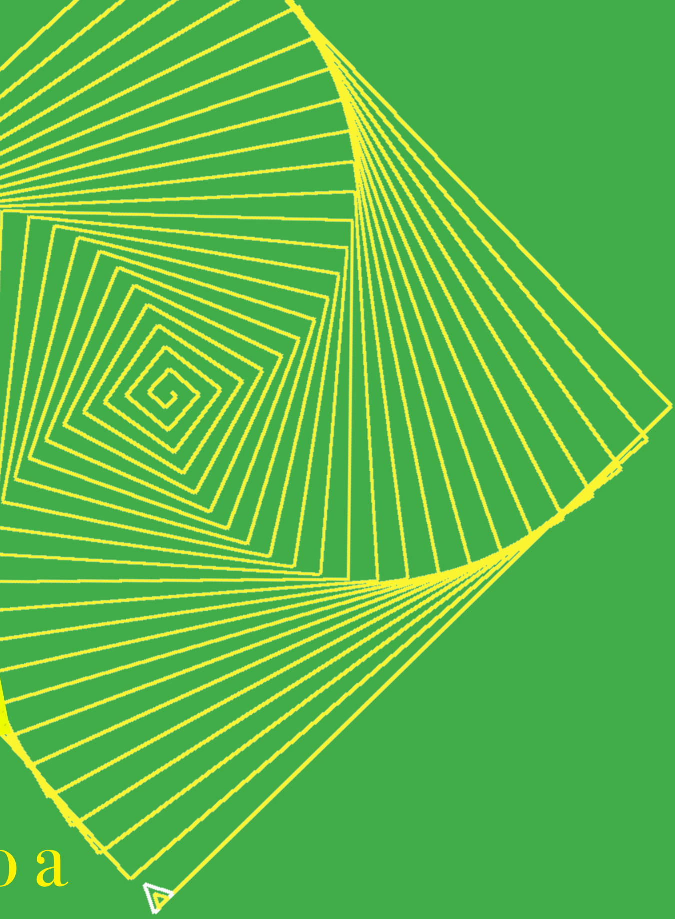
*TRS-80, APPLE II, and PET are trademarks of Tandy Corp., Apple Computer Co., and Commodore Business Machines, respectively.

ORATED
venue, Mountain View, CA 94043



Realize day-in and day-out solid performance from a quiet and capable desktop plotter. It's true. For only $2295* the Houston Instrument HIPLØT™DMP-29 will provide you with world-
multi-color hard copy graphics, and
a level of quality and performanc
ld expect in a plotter costing
much.





You can do a lot with straight lines!

The story is often the same now as it was in the 1980s: you start up Logo, you figure out how to SHOWTURTLE, then you type FORWARD 10 and the turtle moves ahead a little. You get a bit more adventurous and type RIGHT 90, then FORWARD 10 again and repeat it until you have a square, at which point you become quite pleased with yourself but then get stuck as to what to do next.

Well, to do fancier stuff you need to know a few things. First, you can create procedures (lists of commands like FORWARD 10) by first typing TO <name> (where <name> is whatever you want to call the procedure), the commands you want and then END. So, for example:

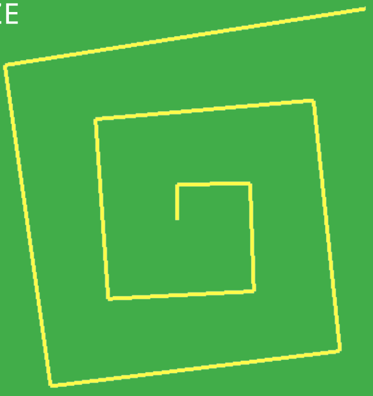
```
TO SQUARE
FD 10
RT 90
FD 10
RT 90 ...
END
```

OR

```
TO SQUARE
REPEAT 4[FD 10
 RT 90]
END
```

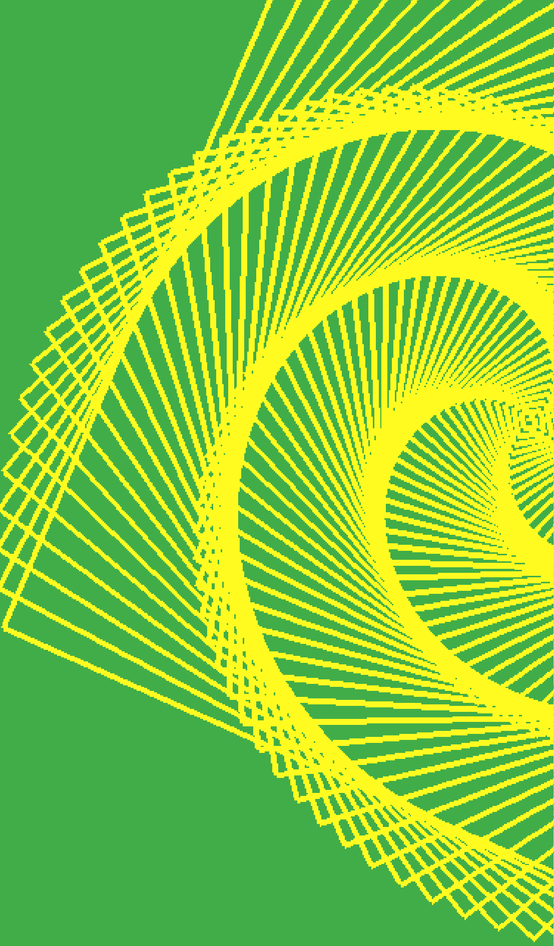
```
(indented lines
are a continuation
of the previous
line)
```

```
TO DRAW :SIZE
MAKE “SIDE :SIDE + 2
FORWARD :SIDE
RT 89
IF :SIDE < :SIZE [DRAW :SIZE]
END

TO SQUIRAL :SIZE
SHOWTURTLE
CLEARSCREEN
MAKE “SIDE 0
DRAW :SIZE
END

SQUIRAL 20
```



The equivalent to the BASIC command LET, which assigns values to variables is MAKE “variable
To use that variable with a function you precede it with a colon, for example :variable

Ancient



LOGO: Language of the 80's

LOGO: Language of the 80's

Apple Logo and **Logo for the Apple II** introduce you to a dynamic new computer language that not only enables educators to make full and innovative use of the teaching potential of modern computers but also offers programmers an easy-to-use system of considerable power.

Readers of this book will see that the designers' vision of Logo as a virtually unlimited educational tool has now become a reality. Logo enables even young children to use the computer in rewarding, self-directed projects, while at the same time providing sophisticated users with a powerful and expressive general programming system. This book presents the reader with a complete guide to the exciting applications of this unique procedural language.

The author introduces programming techniques through Turtle Geometry—a series of fascinating exercises involving both Logo programming and geometric concepts. Later chapters illustrate more advanced projects that utilize Logo's sophisticated list-processing capabilities; these include the conversational DOCTOR program with its simulated psychotherapist and an INSTANT program with which parents and teachers can create a programming environment for preschool children. The book also contains reference material of enduring value to sophisticated users.

Get in on the ground floor of the burgeoning Logo movement with this comprehensive, detailed guide to the up-and-coming computer language of the Eighties!

This book is published in two versions: **Apple Logo** is for users of Apple Logo™ software (distributed by Apple Computer Company) and contains an appendix for users of TI Logo™. **Logo for the Apple II** is specifically for users of Logo software developed at MIT for the Apple II computer (distributed by Krell Software and Terrapin, Inc.). **Logo for the Apple II** also contains appendices that enable users of Apple Logo™ and TI Logo™ to carry out the projects in the book. Be sure to specify **Apple Logo** or **Logo for the Apple II** when ordering!

Apple Logo	**Logo**
$14.95	**$14.95**
240 pages,	**240 pages,**
softcover, illustrated	**softcover, illustrated**

ORDER TOLL FREE
800-258-5420

BYTE Books
70 Main St.
Peterborough, N.H. 03458

There are plenty of books on Logo available
on the Internet Archive at https://archive.org
Good searches include introducing logo
logo manual
logo reference
and byte logo

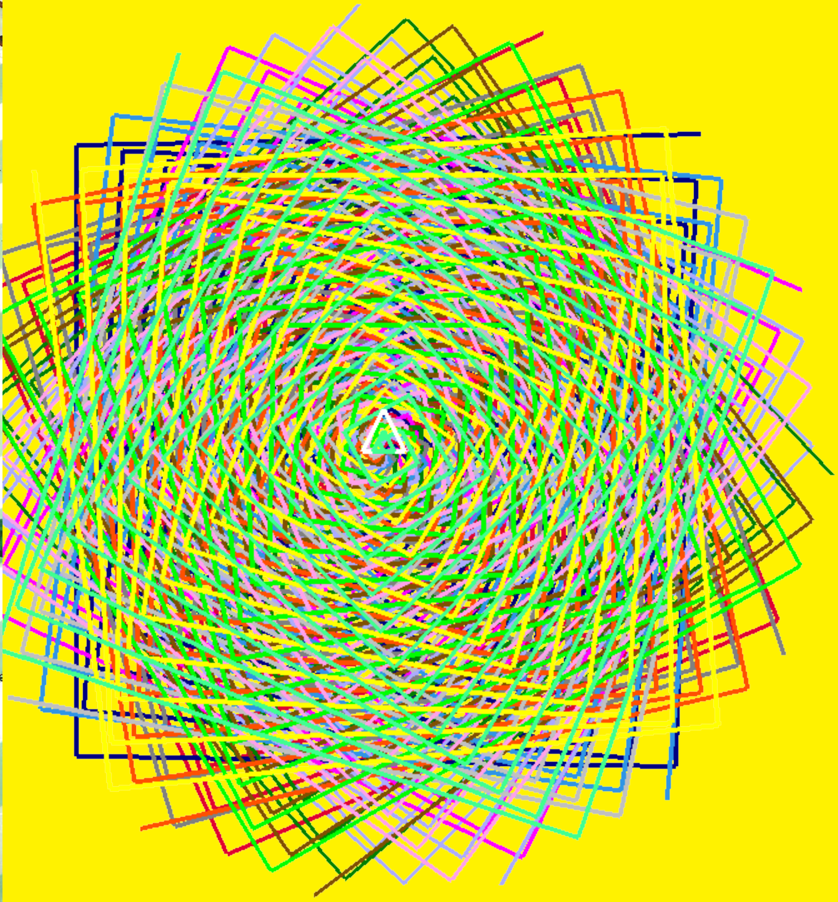
Logo's most memorable feature is the turtle. In fact, many interpreters were written that only contained looping and branching instructions, simple variables and the basic set of turtle commands: FORWARD (FD), RIGHT (RT) and LEFT (LT). These 'Turtle Graphics' programs let users use the turtle like an etch-a-sketch or a spirograph, without the overhead of Logo's advanced functionality.

Some modern Logo interpreters (such as microM8's microLogo) add UP and DOWN (DN) so that the turtle can move in 3D space.

```
TO DRAW :SIZE
MAKE “SIDE :SIDE + 2
FORWARD :SIDE
RT 89
UP 10
IF :SIDE < :SIZE [DRAW :SIZE]
END
```

SQUIRAL 100

```
FULL SCREEN
HIDETURTLE
MAKE "BIGUNIT 100
BIGSQ (2 * :BIGUNIT)
SETPROPS
REPEAT :TIMES [MOVEBUG 1 MOVEBUG 2 MOVEBUG 3 MOVEBUG 4]
END
```



```
TO DRAW :SIZE
MAKE “SIDE :SIDE + 2
FORWARD :SIDE
RT 89
(ADD UP 10 HERE FOR 3D)
IF :SIDE < :SIZE [DRAW :SIZE]
END

TO SQUIRAL :SIZE
DRAW :SIZE
PU
HOME
PD
MAKE “COUNT :COUNT + 24
MAKE “COLOR :COLOR + 1
RT :COUNT
SETPC :COLOR
MAKE “SIDE 0
END
```

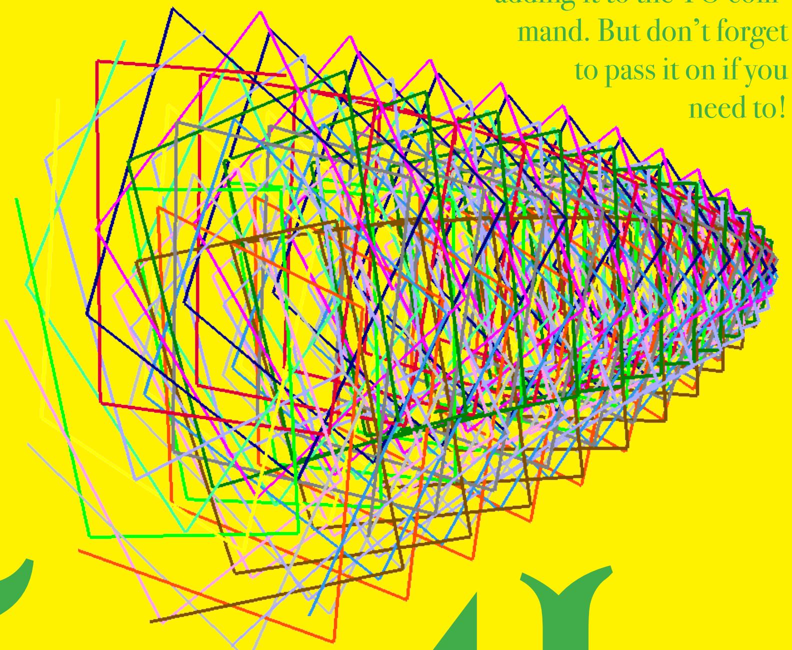
After all three procedures are entered, type `SQUIRALCOL 100`

SETPC sets the colour of the turtle’s ‘pen’, and everything it draws after that will be in that colour. The number of available colours varies depending on the version of Logo you’re using.

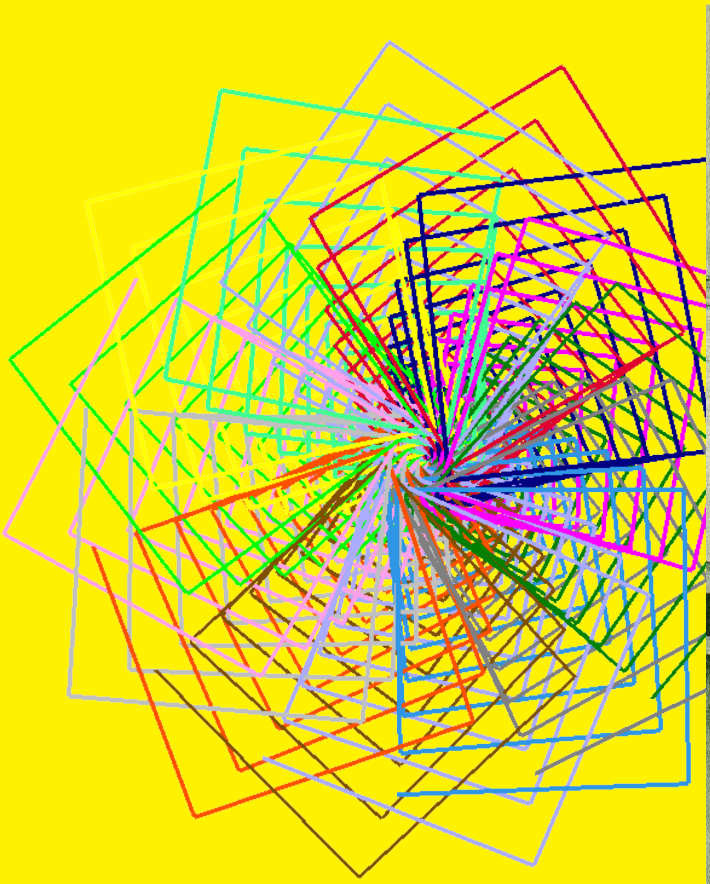
```
TO SQUIRALCOL :SIZE
SHOWTURTLE
CLEARSCREEN
MAKE “SIDE 0
MAKE “COUNT 0
MAKE “COLOR 0
REPEAT 15[SQUIRAL :SIZE]
END
```

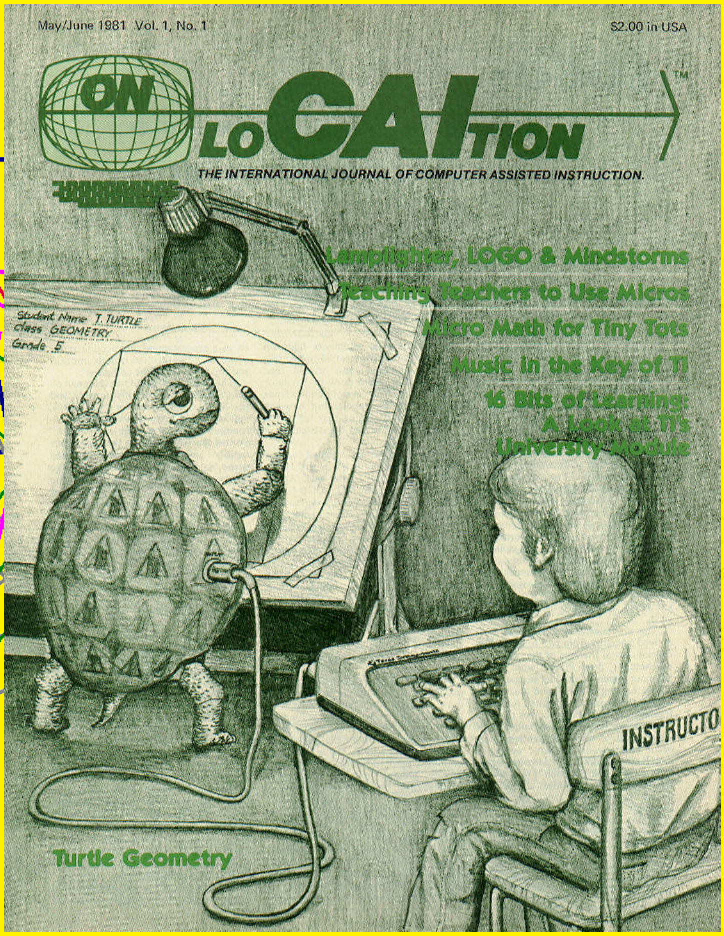
The IF directive is similar to BASIC IF. You compare two :variables and then say what you want Logo to do if the comparison is true in the following square brackets.

You can pass a parameter to a procedure by adding it to the TO command. But don’t forget to pass it on if you need to!



Turtle





May/June 1981 Vol. 1, No. 1

$2.00 in USA

ON LOCAITION

THE INTERNATIONAL JOURNAL OF COMPUTER ASSISTED INSTRUCTION.

Lamplighter, LOGO & Mindstorms

Teaching Teachers to Use Micros

Micro Math for Tiny Tots

Music in the Key of TI

16 Bits of Learning: A Look at TI's University Module

Turtle Geometry

microLogo also adds ROLLLEFT (RL) and ROLLRIGHT(RR) which ‘rolls’ the turtle left or right by the provided number of degrees. By simply adding a RR 10 to the DRAW procedure, we can dramatically affect how the final drawing looks. Compare the output on the previous page to the output on this one.

Feel free to change the RR, UP and even the RT values and see what happens! The SQUIRAL program is a good starting place for plenty of fun and inspiration.

But don’t forget to `SAVE “SQUIRAL` or you’ll have to type it all in again!

```
TO DRAW :SIZE
MAKE “SIDE :SIDE + 2
FORWARD :SIDE
RT 89
UP 10
RR 10
IF :SIDE < :SIZE [DRAW :SIZE]
END

SQUIRALCOL 100
```

When Logo was introduced in the early 1980s it became popular as a teaching language for children. The turtle was like a little robot that you could command, which seems almost inane today but there were few practical opportunities at that time to develop the skills associated with that sort of scripted direction. Logo provided an excellent opportunity.

The interactive and immediate qualities of the Logo turtle meant that children could jump in and start moving the turtle around almost instantly, the relative nature of its direction intuitive to most of them, and allowing for the creation of complex designs in just a few lines of code.

Artistry

Photo 1: *The opening page from "Nancy Reagan Takes the Subway," an interactive comic strip by Maria Manhattan.*

104 July 1983 © BYTE Publications Inc

These graphics were taken from Byte magazine, July 1983.

Videotex: an early experiment in art delivered digitally

So, we've seen that digital creativity in the 1980s had a few avenues that could be explored: Logo let you draw to the screen programatically with the turtle, you could paint on the CRT with a light pen colouring pixels, you could create vector line art and then draw it on paper with a plotter, you could create portaits using an Amiga and a black and white video camera like Andy Warhol – but in the 1980s, could you actually then share your artwork digitally the way we do today?

These days we take the idea of graphical telecomputing for granted. The world-wide web allows us to share photos and artwork on social networks with relative ease, we can design sophisticated interactive web pages rich with graphical content. However, in the late 20th century information was usually distributed to people on paper, and what digital services there were delivered their data in simple plain text.

NANCY REAGAN TAKES THE SUBWAY
By Maria Manhattan............ 1
SNAPSHOTS
By Mary Beams.................. 2
STARBOY
By Lady McCrady................ 3
CULTURAL PATTERNS
By Wendy Richmond.............. 4
CALENDAR STORY
By Susan Rubin................. 5
ABDULLAH
By Mark Ginsburg............... 6
FRAMES
Selected Artists............... 7
LISTINGS
L.A. Arts Organizations........ 8

Photo 5: *The contents page from NEA videotex magazine.*

In the late 1960s researchers in several countries looked into ways in which data could be delivered to home users. There were two competing options: teletext, which was delivered over radio waves (typically as part of a television signal) and videotex, which was sent over the phone lines using a modem. Unlike teletext, videotex had the advantage of being two-way, allowing for true interactivity with the user.

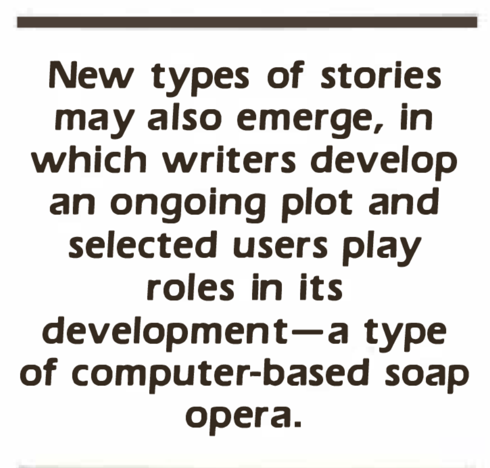
In the UK, British Telecom (then the General Post Office) developed a videotex system known as Viewdata, which they launched as Prestel in 1979. During development it was agreed that both teletext services (such as the BBC's Ceefax) and videotex services would use the same video standard of a 40x24 text mode with some graphics characters. This led to the teletext art we've covered in previous issues, which although interesting is quite limited in scope (so limited it's amazing what people have been able to come up with!). A similar standard was used in France.

In Canada, however, researchers at the Communications Research Centre in Ottawa wanted something a bit more flexible, and so they devised a different standard, one that encoded graphics instructions as text, with each instruction represented by an ASCII character. Text was sent by bookending it with "shift in" and "shift out" characters. This protocol allowed for complex images to be transmitted in vector form and then reconstructed by the destination terminal (computer or set-top box). However, it also required more sophisticated computer hardware in order to decode the data, which meant terminals were more expensive then teletext-based terminals.

In 1978 a prototype system was demonstrated, and in 1979 planning for trials of the system, known as Telidon, began.

Photo 2: *A page from "Snap Shots" by Mary Beams. Note use of textures.*

Photo 3: *A page from Wendy Richmond's "Cultural Patterns."*



New types of stories may also emerge, in which writers develop an ongoing plot and selected users play roles in its development—a type of computer-based soap opera.

The organisers of the workshop speculated that the interactivity that the Telidon platform could potentially facilitate between artists and viewers could be leveraged to create interactive works, the development of which could be witnessed and influenced by Telidon users. This sort of reactive digital art presentation is something that we think of as a relatively modern invention, bestowed on us by the Internet, but people were thinking about doing it using videotex in 1981! However, circumstances would conspire to postpone their dreams for over a decade.

It wasn't long before American telecommunications company AT&T expressed an interest in the Telidon service. In the late 1970s it had experimented with the idea of a videotex service, and it was intrigued by the flexibility of the Telidon system. In the early 1980s it began adapting it for its own purposes, adding additional functionality and planning a rollout of a US-wide commercial videotex system.

In part due to AT&T's involvement, videotex was soon speculated by many media outlets to imminently become popular and its use widespread by companies, educational organisations and the government. It was declared that videotex terminals would soon become as common as telephones. After all, the concept of digital real-time access to information and services was a novelty for most, and it seemed reasonable to assume that ability was something everyone would want. Videotex was sure to be a hit.

Against that background, arts organisations began considering the artistic potential of the supposedly coming 'videotex revolution', and in 1981 the US National Endowment for the Arts funded an artists workshop, run by New York University's Alternate Media Centre, to explore videotex's creative possibilities. They wanted to identify the stylistic capabilities and limitations of the Telidon system's graphics protocol.

Artists would be invited to come and learn how to use the Telidon terminals, and then create artworks that would be included in content distributed over videotex systems in the United States and Canada. The workshop had three major goals: to allow time for artistic experimentation with the system, to engage a diversity of artists from different backgrounds and of differing levels of digital literacy, and to establish a framework for standardising graphical videotex content to ensure legibility and consistency of viewing across different videotex systems and terminals, taking into account the variety of content an artist could produce.

Ten artists were selected to take part in the workshop, nine of whom had no previous experience with computer graphics. Most of the participants were creating complex graphics after three or four sessions, although some were not capable of creating 'production quality' images until they had a few months of experience using the Telidon hardware.

However, the artists weren't just creating stand-alone images; they took advantage of the navigational capabilities of the Telidon system (a structure similar to modern-day web pages) to create not just sequential cartoons but semi-interactive presentations, for example one had the user moving from one room in a virtual house to another, and reading a short story in each. This was quite advanced for 1981, a time when doing something similar typically required programming a computer from scratch.

During the sessions a few things were learned. Artists found they were limited by the system's palette of six colours and six shades of grey. However, they discovered they could work around that limitation by using dithering, where two colours are used in a checkerboard-like pattern to create the illusion of a third, or by halftoning, where differently-sized or spaced spots of colours create the impression of varying levels of darkness or lightness. But these methods also made the artworks more complex and data-heavy, and the slow transmission speeds of videotex (around 150 characters, or in the case of videotex, graphics instructions, per second) meant such images appeared very slowly. Consequently, it was decided these techniques would be used sparingly.

Simplicity was identified as a strategy fundamental to the effective design of videotex graphics: the ideal image could get both its artistic and conceptual messages across while keeping its overall data size low. For this reason, animation was experimented with but determined that attempts were largely distracting and cumbersome.

Legibility was identified as an issue in the use of text. The resolution of the videotex terminals was not high, and would often be displayed on television sets using RF (radio frequency) modulators, which made the presentation of large amounts of text somewhat challenging. Short sentences and paragraphs, displayed in large type, were best.

Various visual cues to help users navigate presentations were experimented with, and in some cases became part of the uniqueness of each. In one case, the navigation itself became a game, where users had to decipher the meaning of symbols in order to navigate through it.

The end result of the workshop was an electronic magazine with 425 pages containing works by the ten artists, and index pages. It was presented on videotex systems in New York and Saskatchewan, and shown at video festivals in Los Angeles and Washington DC.

The Telidon system allowed for the display of seven different geometric primitives, including dots, lines (solid, dashed or dotted), rectangles, arcs, circles, polygons and text characters. Line and fill colours could be specified, and more complex shapes could be created by overlaying shapes on top of each other. However, each shape took a certain amount of time to transmit and display, so designers had to take care not to use too many of them, so that their image didn't take forever to load!

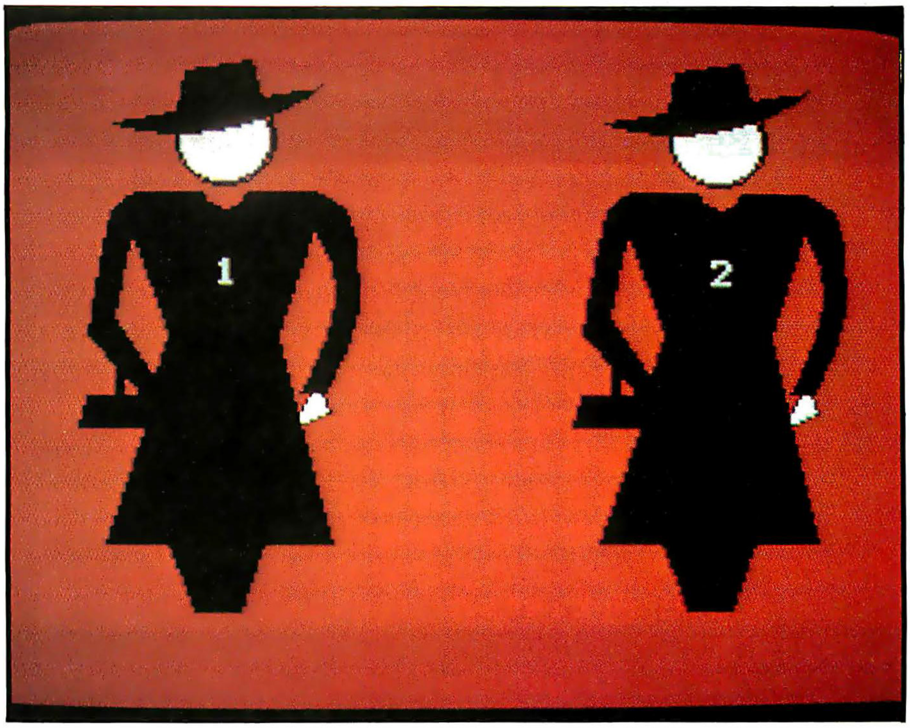


Photo 4: *A pictogram game developed by Martin Nisenholtz, called "Mystery of the Drink."*

The workshop's organisers concluded that, while it had technical limitations, the videotex system had potential as an outlet for creative expression, more so than teletext. Additionally, they speculated regarding the potential for the system to facilitate communication between artists (for collaboration and critique) and with consumers of their art, to perhaps drive artistic creation or enable sales or promotion – and they were correct, these are all common uses of today's Internet. Videotex's future looked bright.

So what happened?

Why didn't videotex take off?

Firstly, the terminals were expensive. In order to display vector-based graphics they needed (for the time) near state-of-the-art microcomputing hardware. Secondly, home computers were becoming a thing, and they weren't much more expensive. When faced with the choice between the two, consumers opted for the computers, even though the only communication services you could connect to with them were strictly text. Videotex software was produced for some home computers, but many videotex providers sent information over cablevision systems, meaning the purchase of additional hardware to recieve it. Videotex was also typically slow, and many users were impatient. Despite several efforts at creating a commercially viable videotex system, they had largely died out by the mid-1980s...

...with one notable exception. Prodigy was an online service launched in 1984 that used the Telidon's communication protocol (known as NAPLPS, the North American Presentation Layer Protocol Syntax) to provide a graphical experience to its users. Unlike other videotex services, Prodigy worked strictly using home-computer software and standard telephone modems, so the up-front costs to the consumer were lower.

In order to solve the speed issue, many of the common graphics and user interface elements were bundled into the Prodigy software, lessening transactions between the server and the client. The software had an internal programming language interpreter that could execute software sent by the server on the local machine, and also appears to have cached data to additionally speed up loading times.

All of these elements combined to mitigate the deficiencies of earlier videotex attempts, and Prodigy was successful, offering its videotex-based service until 1999, when it was forced to close due to it not being Y2K compliant. But by then there was the Internet, and HTML.

The graphics and music in videogames may be an art-form all their own but while videogame consoles provide their owners with an opportunity to appreciate them, they are not generally designed to also give those owners the ability to create them.

Facing mounting criticism from parents, educators and even legislators regarding the limited non-entertainment value of its products, Nintendo sought to counter that criticism with Mario Paint.

Videogame consoles such as the Super Nintendo had developed a poor reputation as instruments of consumption, creativity having exclusively been the domain of computers. Nintendo wanted to have at least one thing they could point potential Super Nintendo owners toward that demonstrated the console's capability to foster creativity in their children – a salve to soothe the concerns of parents.

To that end, Mario Paint was released in 1992. Mario Paint allowed SNES users to create digital works of art. It included a mouse, not just to improve the user's ability to draw, but also (let's be honest) to make the SNES seem more like a computer.

MARIO PAINT

UK Release

Game: Mario Paint
Publisher: Nintendo
Developer: In-house
Price: £59.99
Players: 1
Cart ROM: 8 Mbit + BB

To date the only non-game that's been released for the Super Nintendo, *Mario Paint* is actually a very simplified, friendlied-up version of the sort of paint packages you get on home computers. It has one very big flaw – the fact that you can't save more than one picture into the battery backed-up memory, and the only other thing you can do with your creations is (fiddlily) record them onto video cassette – but otherwise comes across as quite a neat, if limited and rather crude, affair. Everything you draw comes out looking hopelessly chunky, for instance, and while things are presented with Nintendo's usual panache and humour, the lack of colours (there are only 16 available) does limit things somewhat.

Firmly aimed at youngsters, and bound to be appreciated most by them, *Mario Paint* is fun but limited stuff. Still, coming up with little six-frame animations is something everyone can have fun with, and the music composition bit can be a laugh, too.

Don't write this off too quickly has to be the gist of things, then. And, of course, it's the only way to get a mouse.

THE ONLY SUPER NINTENDO MOUSE IN THE WORLD!

Mario Paint comes complete with the only mouse designed to fit the Super Nintendo, something that's bound to become very useful on other games (especially RPGs, flight sims and things like *Populous*), if only the game designers allow for it – and lots of them are. It's almost reason alone for this game/paint program/whatever to be encouraged.

The animation feature lets you do up to six little doodles, and then flip between them to create animation. Of course, it helps if you can draw...

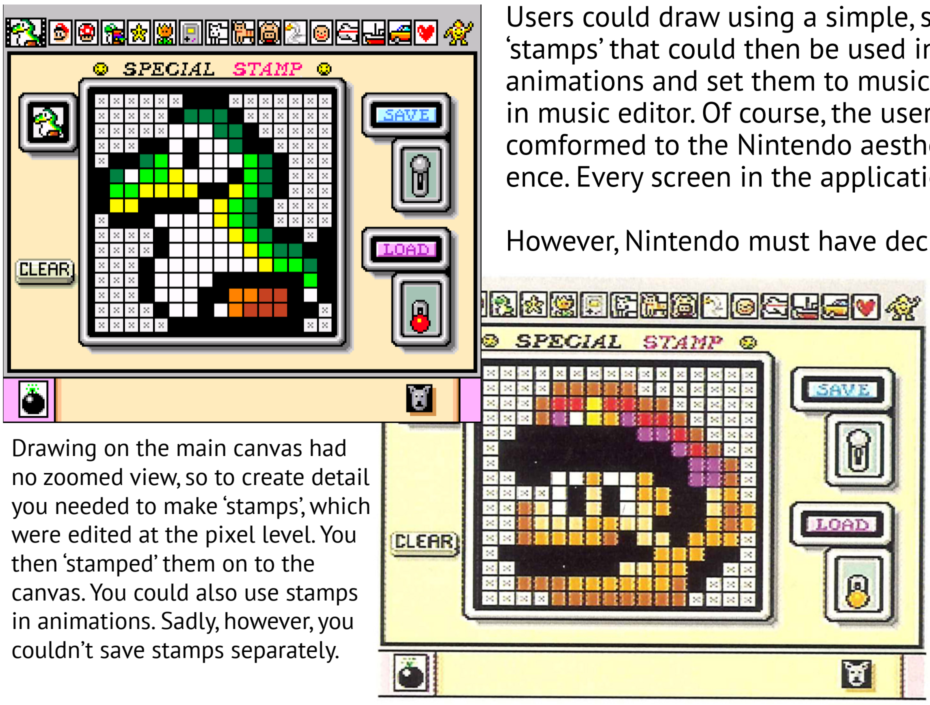
GRAPHICS	SOUND	GAMEPLAY
70%	60%	60%
GAMELIFE	OVERALL SCORE:	55%
45%		

VERDICT: Fun for kids, but it could have been so much better. The mouse is worth having, though.

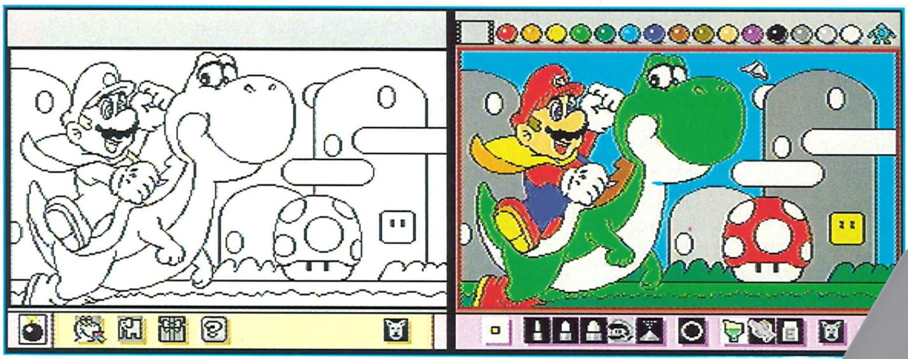
SUPER PLAY GOLD SUMMER SPECIAL

Users could draw using a simple, straightforward interface, and create 'stamps' that could then be used in drawings. They could also create animations and set them to music composed using Mario Paint's built-in music editor. Of course, the user-interface elements in Mario Paint comformed to the Nintendo aesthetic, creating a very Mario-like experience. Every screen in the application is designed to be fun.

However, Nintendo must have decided that Mario Paint was still not 'fun' enough, as they also added a few other videogame-inspired elements (or maybe Nintendo just couldn't help themselves) to keep users entertained (and their brand on-message). These included 'easter eggs' hidden on the title screen (clicking each letter in the title causes silly things to happen, such as Yoshi running across the screen, for example) and a 'mini-game' where the user swats flying insects with the mouse, called Gnat Attack.



Drawing on the main canvas had no zoomed view, so to create detail you needed to make 'stamps', which were edited at the pixel level. You then 'stamped' them on to the canvas. You could also use stamps in animations. Sadly, however, you couldn't save stamps separately.



In the Mario Paint 'Player's Guide', Nintendo declared "Computer paint programs may be more sophisticated, but they don't cover as much ground". We're supposing they mean Mario Paint's ability to create animation and music. Which you could do.

With Mario Paint you can create an animation of up to 9 frames (the more frames, the smaller the animation). You can superimpose the animation over a background, and create a path for the animation to move on over time, such as Mario walking across the screen.

The music part is also amusing. Give it a shot. (You can try a web version at https://danielx.net/composer/)

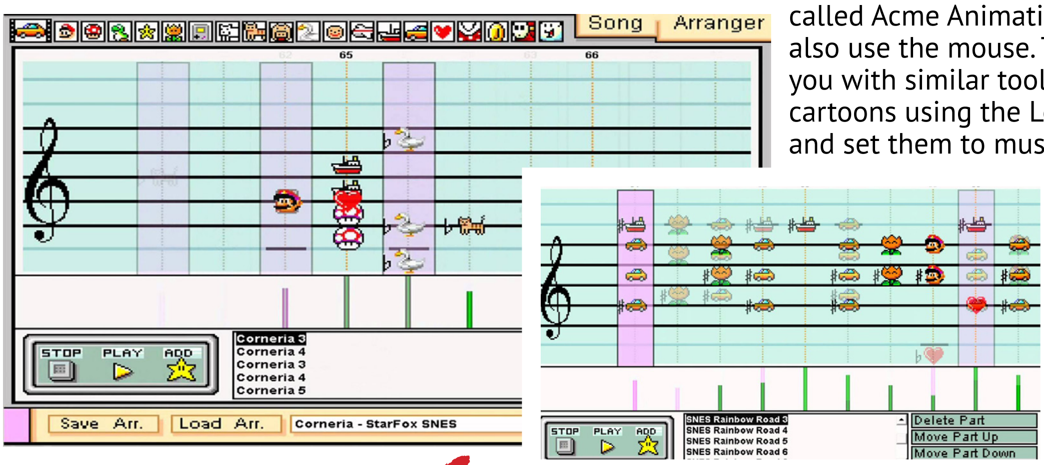
Unfortunately, you could only save a single workspace – if you saved a new canvas (or a stamp without first loading the old canvas) you would lose your previously saved work. There there wasn't any other method of keeping your previous creations other than by taping them using a VCR.

The Super NES mouse could be used for more than just Mario Paint: several games also used it, including a version of Arkanoid (Doh It Again), Doom, Wolfenstein 3D, SimAnt, Lemmings 2 and a few card games.

As an aside, the Mario Paint Player's Guide is quite extensive and worth a look, as of this writing it was available on-line at https://annarchive.com/files/Mario%20Paint%20-%20SNES%20-%20Nintendo.pdf

It contains a number of pixel artworks and example songs that you can manually transcribe into Mario Paint and play.

Mario Paint inspired another 'creativity game' called Acme Animation Factory. It could also use the mouse. The cartridge provides you with similar tools to create animated cartoons using the Looney Tunes characters, and set them to music.



Different icons make sounds of different instruments, including drums. You place them on the staff and they are triggered when the 'play head' sweeps over them during playback.

PIXEL PLAYAS

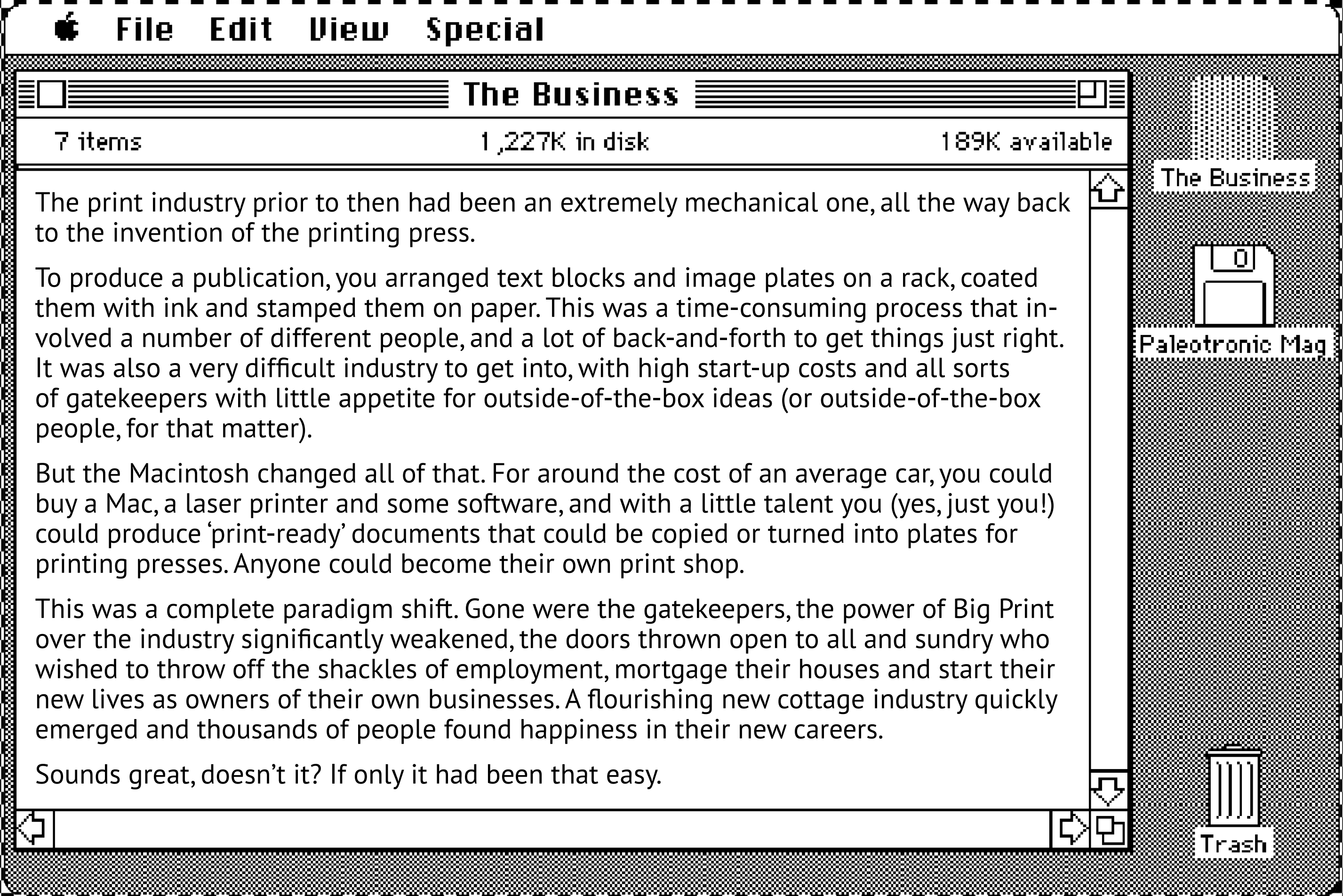
The Business

7 items 1,227K in disk 189K available

HOW TO MAKE MONEY USING COMPUTERS...

sounds like the title of a bargain book, but in the late 1980s it was a dream-come-true for many a budding desktop publisher.

Or it was for some of them, anyway...



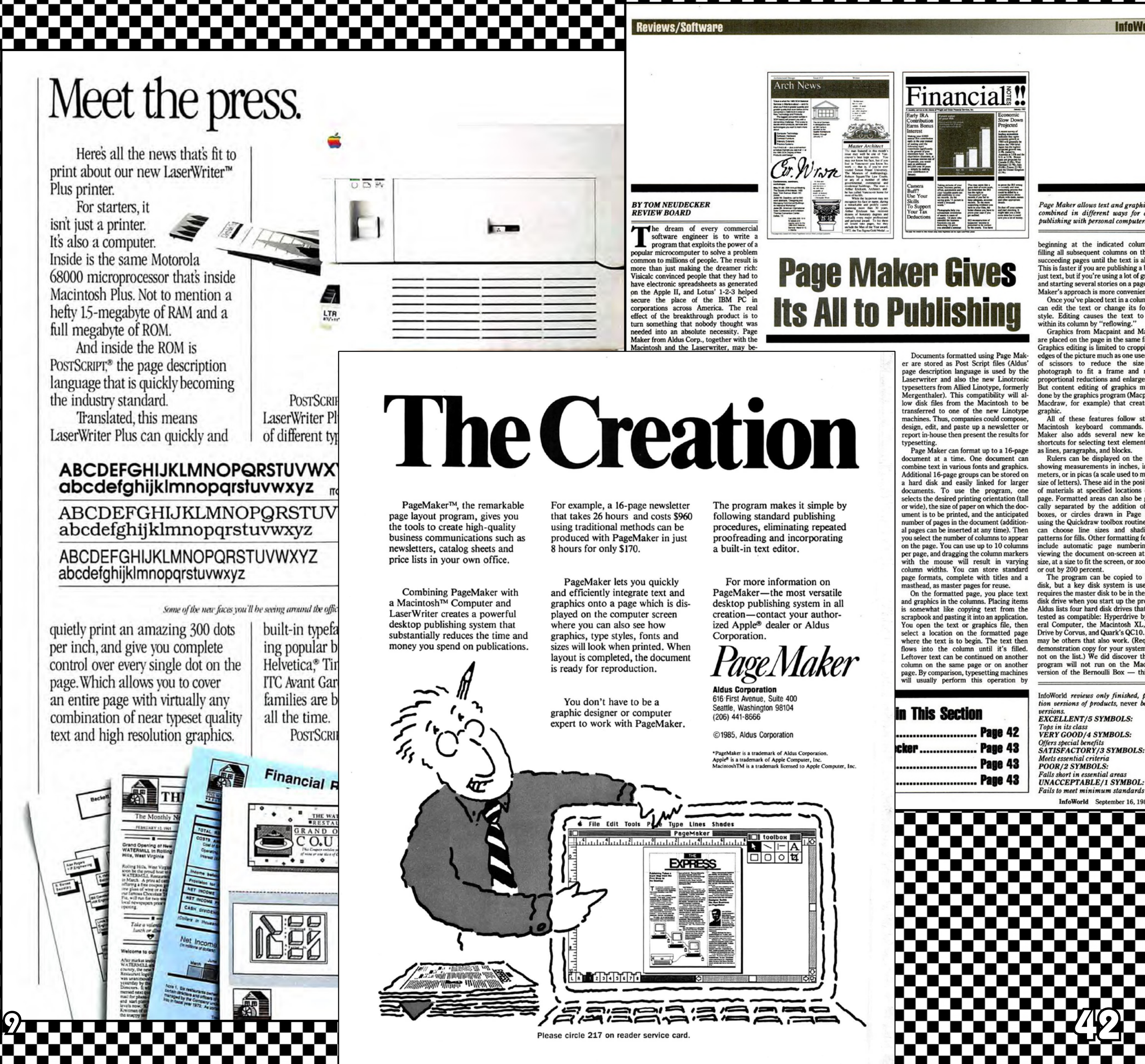
The print industry prior to then had been an extremely mechanical one, all the way back to the invention of the printing press.

To produce a publication, you arranged text blocks and image plates on a rack, coated them with ink and stamped them on paper. This was a time-consuming process that involved a number of different people, and a lot of back-and-forth to get things just right. It was also a very difficult industry to get into, with high start-up costs and all sorts of gatekeepers with little appetite for outside-of-the-box ideas (or outside-of-the-box people, for that matter).

But the Macintosh changed all of that. For around the cost of an average car, you could buy a Mac, a laser printer and some software, and with a little talent you (yes, just you!) could produce 'print-ready' documents that could be copied or turned into plates for printing presses. Anyone could become their own print shop.

This was a complete paradigm shift. Gone were the gatekeepers, the power of Big Print over the industry significantly weakened, the doors thrown open to all and sundry who wished to throw off the shackles of employment, mortgage their houses and start their new lives as owners of their own businesses. A flourishing new cottage industry quickly emerged and thousands of people found happiness in their new careers.

Sounds great, doesn't it? If only it had been that easy.



Meet the press.

Here's all the news that's fit to print about our new LaserWriter™ Plus printer.

For starters, it isn't just a printer. It's also a computer. Inside is the same Motorola 68000 microprocessor that's inside Macintosh Plus. Not to mention a hefty 1.5-megabyte of RAM and a full megabyte of ROM.

And inside the ROM is PostScript,® the page description language that is quickly becoming the industry standard.

Translated, this means LaserWriter Plus can quickly and quietly print an amazing 300 dots per inch, and give you complete control over every single dot on the page. Which allows you to cover an entire page with virtually any combination of near typeset quality text and high resolution graphics.

PostScri
LaserWriter Pl
of different typ
built-in typefa
ing popular b
Helvetica,® Ti
ITC Avant Gar
families are b
all the time.
PostScri

ABCDEFGHIJKLMNOPQRSTUVWX
abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUV
abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

Some of the new faces you'll be seeing around the offic

Reviews/Software

InfoWo

Arch News

Financial NOTES!!

Page Maker Gives Its All to Publishing

**BY TOM NEUDECKER
REVIEW BOARD**

The dream of every commercial software engineer is to write a program that exploits the power of a popular microcomputer to solve a problem common to millions of people. The result is more than just making the dreamer rich: Visicalc convinced people that they had to have electronic spreadsheets as generated on the Apple II, and Lotus' 1-2-3 helped secure the place of the IBM PC in corporations across America. The real effect of the breakthrough product is to turn something that nobody thought was needed into an absolute necessity. Page Maker from Aldus Corp., together with the Macintosh and the Laserwriter, may be-

Documents formatted using Page Maker are stored as Post Script files (Aldus' page description language is used by the Laserwriter and also the new Linotronic typesetters from Allied Linotype, formerly Mergenthaler). This compatibility will allow disk files from the Macintosh to be transferred to one of the new Linotype machines. Thus, companies could compose, design, edit, and paste up a newsletter or report in-house then present the results for typesetting.

Page Maker can format up to a 16-page document at a time. One document can combine text in various fonts and graphics. Additional 16-page groups can be stored on a hard disk and easily linked for larger documents. To use the program, one selects the desired printing orientation (tall or wide), the size of paper on which the document is to be printed, and the anticipated number of pages in the document (additional pages can be inserted at any time). Then you select the number of columns to appear on the page. You can use up to 10 columns per page, and dragging the column markers with the mouse will result in varying column widths. You can store standard page formats, complete with titles and a masthead, as master pages for reuse.

On the formatted page, you place text and graphics in the columns. Placing items is somewhat like copying text from the scrapbook and pasting it into an application. You open the text or graphics file, then select a location on the formatted page where the text is to begin. The text then flows into the column until it's filled. Leftover text can be continued on another column on the same page or on another page. By comparison, typesetting machines will usually perform this operation by

*Page Maker allows text and graphi
combined in different ways for
publishing with personal computer*

beginning at the indicated colum
filling all subsequent columns on th
succeeding pages until the text is al
This is faster if you are publishing a
just text, but if you're using a lot of g
and starting several stories on a page
Maker's approach is more convenier

Once you've placed text in a colum
can edit the text or change its fo
style. Editing causes the text to
within its column by "reflowing."

Graphics from Macpaint and M
are placed on the page in the same f
Graphics editing is limited to croppi
edges of the picture much as one use
of scissors to reduce the size
photograph to fit a frame and
proportional reductions and enlarge
But content editing of graphics m
done by the graphics program (Macp
Macdraw, for example) that creat
graphic.

All of these features follow st
Macintosh keyboard commands.
Maker also adds several new ke
shortcuts for selecting text element
as lines, paragraphs, and blocks.

Rulers can be displayed on the
showing measurements in inches, i
meters, or in picas (a scale used to m
size of letters). These aid in the posi
of materials at specified locations
page. Formatted areas can also be
cally separated by the addition of
boxes, or circles drawn in Page
using the Quickdraw toolbox routine
can choose line sizes and shadi
patterns for fills. Other formatting fe
include automatic page numberin
viewing the document on-screen at
size, at a size to fit the screen, or zoo
or out by 200 percent.

The program can be copied to
disk, but a key disk system is use
requires the master disk to be in the
disk drive when you start up the pr
Aldus lists four hard disk drives tha
tested as compatible: Hyperdrive b
eral Computer, the Macintosh XL,
Drive by Corvus, and Quark's QC10.
may be others that also work. (Req
demonstration copy for your system
not on the list.) We did discover th
program will not run on the Ma
version of the Bernoulli Box — th

In This Section

InfoWorld *reviews only finished,
tion versions of products,* never b
versions.
EXCELLENT/5 SYMBOLS:
Tops in its class
VERY GOOD/4 SYMBOLS:
Offers special benefits
SATISFACTORY/3 SYMBOLS:
Meets essential criteria
POOR/2 SYMBOLS:
Falls short in essential areas
UNACCEPTABLE/1 SYMBOL:
Fails to meet minimum standards

InfoWorld September 16, 19

The Creation

PageMaker™, the remarkable page layout program, gives you the tools to create high-quality business communications such as newsletters, catalog sheets and price lists in your own office.

Combining PageMaker with a Macintosh™ Computer and LaserWriter creates a powerful desktop publishing system that substantially reduces the time and money you spend on publications.

For example, a 16-page newsletter that takes 26 hours and costs $960 using traditional methods can be produced with PageMaker in just 8 hours for only $170.

PageMaker lets you quickly and efficiently integrate text and graphics onto a page which is displayed on the computer screen where you can also see how graphics, type styles, fonts and sizes will look when printed. When layout is completed, the document is ready for reproduction.

You don't have to be a graphic designer or computer expert to work with PageMaker.

The program makes it simple by following standard publishing procedures, eliminating repeated proofreading and incorporating a built-in text editor.

For more information on PageMaker—the most versatile desktop publishing system in all creation—contact your authorized Apple® dealer or Aldus Corporation.

PageMaker

Aldus Corporation
616 First Avenue, Suite 400
Seattle, Washington 98104
(206) 441-8666

©1985, Aldus Corporation

*PageMaker is a trademark of Aldus Corporation.
Apple® is a trademark of Apple Computer, Inc.
MacintoshTM is a trademark licensed to Apple Computer, Inc.

Please circle 217 on reader service card.

AS EASY TO USE AS A TOASTER(?)

Of course, Apple was in the business of selling computers, and so the 'desktop publishing (as graphic design was known at the time) gold rush' that emerged in the years after the release of the Macintosh suited them nicely. They weren't shy about exploiting people's desires for financial and professional freedom, either, running advertising campaigns that touted the Mac's ease-of-use. If you bought into the hype, the Macintosh could give anyone the ability to do almost anything.

But while it was true that the Macintosh was easier to use than other personal computers that came before it, it wasn't magical, and it couldn't bestow instant talent on its user, as much as those who had just spent several thousand dollars on one may have dreamt it could.


How to design and produce the perfect page in 15 minutes

Get ReadySetGo™. Because ReadySetGo automates page design and production, turning your Mac into a professional publishing system.

It's ideal for any project requiring page layout, like a presentation, accurate positioning not possible with the mouse alone.

Keyboard text from scratch or bring it in from other Mac programs. Either way, you get full text editing features with the ability to change font, style and size at any point. ReadySetGo supports all Mac fonts including real typefaces like Times™ and

Training prospective desktop publishers became as lucrative as desktop publishing itself (if not more so) as new Macintosh owners rushed to pull their rapidly smouldering new careers out of the fire.

Of course, ads like the one to the left (for Ready Set Go, one of several desktop publishing software packages) didn't help. But since when has advertising ever been truly honest?

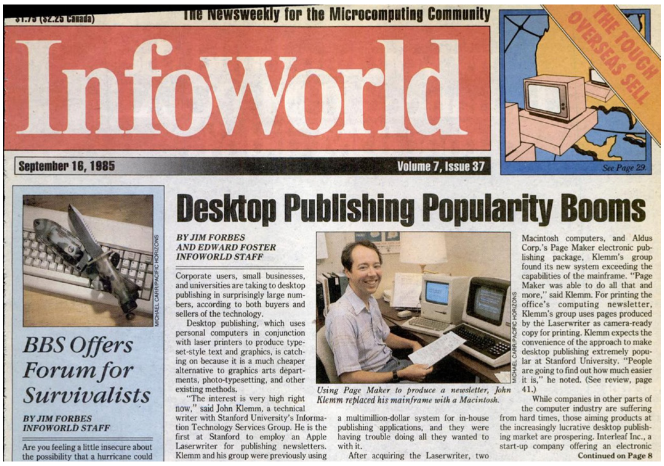
Happily for some it wasn't completely hopeless, and armed with both technolgy and talent, they marched into the future...

THE RACE TO THE BOTTOM...

However, when they got there it wasn't pretty. Sure, they could undercut traditional typesetters and do small-batch publishing much cheaper than the big printing houses, but unless you had the luxury of being the only desktop publisher in town (unlikely) then you would have been forced to deal with competitors – competitors as anxious as you were to establish themselves, and as willing as you were to do whatever it took to survive.

As in any industry some competed on price, and drove each other out of business. Some attempted to compete on quality, but while there is value in more sophisticated design, for most people a brochure was a brochure and they inevitably selected based on price.

It also didn't help that every computer-savvy kid whose parents bought them a Mac (or an Atari ST, or an Amiga) quickly realised they could pirate a desktop publishing program and put themselves out there. It was better than mowing lawns!


$1.75 ($2.25 Canada) The Newsweekly for the Microcomputing Community

InfoWorld

September 16, 1985 Volume 7, Issue 37

THE TOUGH OVERSEAS SELL

See Page 29.

BBS Offers Forum for Survivalists

BY JIM FORBES
INFOWORLD STAFF

Are you feeling a little insecure about the possibility that a hurricane could

Desktop Publishing Popularity Booms

BY JIM FORBES
AND EDWARD FOSTER
INFOWORLD STAFF

Corporate users, small businesses, and universities are taking to desktop publishing in surprisingly large numbers, according to both buyers and sellers of the technology.

Desktop publishing, which uses personal computers in conjunction with laser printers to produce typeset-style text and graphics, is catching on because it is a much cheaper alternative to graphics arts departments, photo-typesetting, and other existing methods.

"The interest is very high right now," said John Klemm, a technical writer with Stanford University's Information Technology Services Group. He is the first at Stanford to employ an Apple Laserwriter for publishing newsletters. Klemm and his group were previously using a multimillion-dollar system for in-house publishing applications, and they were having trouble doing all they wanted to with it.

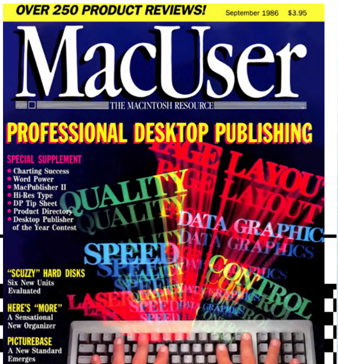
After acquiring the Laserwriter, two Macintosh computers, and Aldus Corp.'s Page Maker electronic publishing package, Klemm's group found its new system exceeding the capabilities of the mainframe. "Page Maker was able to do all that and more," said Klemm. For printing the office's computing newsletter, Klemm's group uses pages produced by the Laserwriter as camera-ready copy for printing. Klemm expects the convenience of the approach to make desktop publishing extremely popular at Stanford University. "People are going to find out how much easier it is," he noted. (See review, page 41.)

While companies in other parts of the computer industry are suffering from hard times, those aiming products at the increasingly lucrative desktop publishing market are prospering. Interleaf Inc., a start-up company offering an electronic

Continued on Page 8

Using Page Maker to produce a newsletter, John Klemm replaced his mainframe with a Macintosh.

MICHAEL CARR/PACIFIC HORIZONS


OVER 250 PRODUCT REVIEWS! September 1986 $3.95

MacUser

THE MACINTOSH RESOURCE

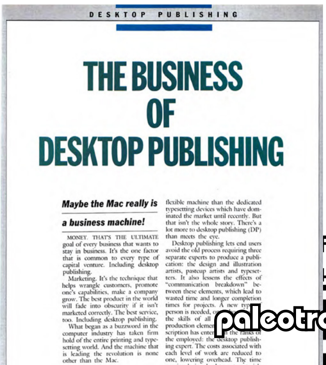
PROFESSIONAL DESKTOP PUBLISHING

SPECIAL SUPPLEMENT
- Charting Success
- Word Power
- MacPublisher II
- Hi-Res Type
- DP Tip Sheet
- Product Directory
- Desktop Publisher of the Year Contest

"SCUZZY" HARD DISKS
Six New Units Evaluated

HERE'S "MORE"
A Sensational New Organizer

PICTUREBASE
A New Standard Emerges


DESKTOP PUBLISHING

THE BUSINESS OF DESKTOP PUBLISHING

Maybe the Mac really is a business machine!

MONEY. THAT'S THE ULTIMATE goal of every business that wants to stay in business. It's the one factor that is common to every type of capital venture. Including desktop publishing.

Marketing. It's the technique that helps wrangle customers, promote one's capabilities, make a company grow. The best product in the world will fade into obscurity if it isn't marketed correctly. The best service, too. Including desktop publishing.

What began as a buzzword in the computer industry has taken firm hold of the entire printing and typesetting world. And the machine that is leading the revolution is none other than the Mac.

flexible machine than the dedicated typesetting devices which have dominated the market until recently. But that isn't the whole story. There's a lot more to desktop publishing (DP) than meets the eye.

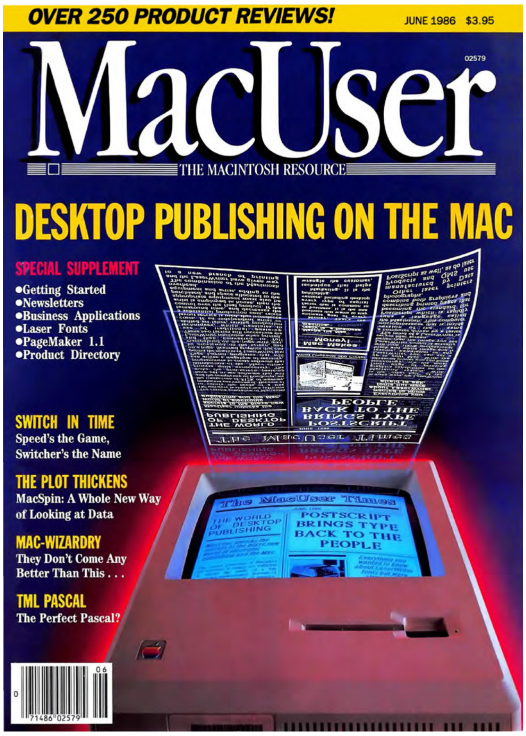
Desktop publishing lets end users avoid the old process requiring three separate experts to produce a publication: the design and illustration artists, pasteup artists and typesetters. It also lessens the effects of "communication breakdown" between these elements, which lead to wasted time and longer completion times for projects. A new type of person is needed, one the skills of all production elements scription has entered the ranks of the employed: the desktop publishing expert. The costs associated with each level of work are reduced to one, lowering overhead. The time

TECHNOLOGY MARCHES ON...

And so, those outfits that survived tended to be the ones who got into the magazine game, providing design and layup for niche publications that couldn't afford to have dedicated staff. Some were tasked with creating advertisements for clients of these publications, and then branched out into designing corporate logos and advertisements for clients more directly. Low-end, unsophisticated commercial 'desktop publishing' largely fell away (left to the kid with the Atari) and morphed into graphic design.

Meanwhile, the Macintosh evolved, shifting from monochrome to colour, and software evolved with it, allowing for in-the-box photo editing and layout of colour publications. Cut-and-paste publishing was completely abandoned, with entire publications being produced digitally, photographs and artwork scanned in, stored on hard disks and sent to the printer on CD-ROM.

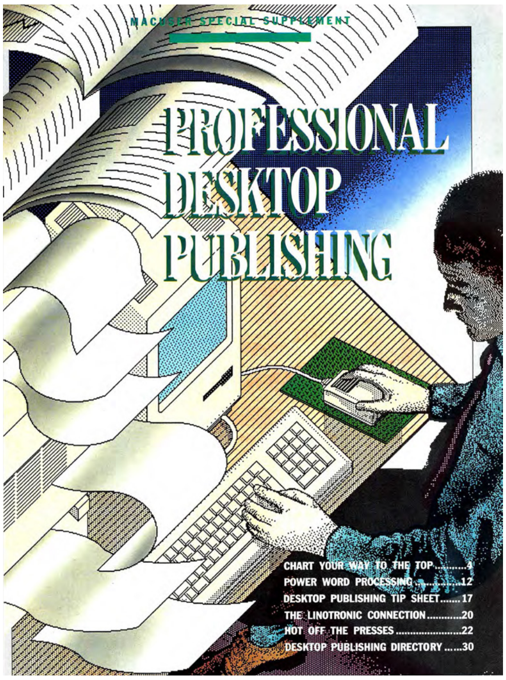
Laser printers became faster, cheaper and colour themselves, allowing for quick proofing and client approvals. Computer speed increases provided additional freedom to designers, who could iterate more quickly and produce better designs. Publications became more sophisticated.


OVER 250 PRODUCT REVIEWS!
JUNE 1986 $3.95
MacUser
THE MACINTOSH RESOURCE
DESKTOP PUBLISHING ON THE MAC
SPECIAL SUPPLEMENT
- Getting Started
- Newsletters
- Business Applications
- Laser Fonts
- PageMaker 1.1
- Product Directory

SWITCH IN TIME
Speed's the Game, Switcher's the Name
THE PLOT THICKENS
MacSpin: A Whole New Way of Looking at Data
MAC-WIZARDRY
They Don't Come Any Better Than This . . .
TML PASCAL
The Perfect Pascal?

Ironically, computer magazines fell all over themselves promoting the magical new abilities of WYSIWYG software to streamline the process of developing print media. But while in the short term computers did make the process cheaper and less complex, in the long term the increasing ubiquitousness of digital devices would eliminate the need for printing entirely, eventually driving the consumer price for information to near zero and creating a crisis within the publishing industry.

THE WORLD OF TOMORROW...


MACUSER SPECIAL SUPPLEMENT
PROFESSIONAL DESKTOP PUBLISHING
CHART YOUR WAY TO THE TOP..........4
POWER WORD PROCESSING..............12
DESKTOP PUBLISHING TIP SHEET.......17
THE LINOTRONIC CONNECTION..........20
HOT OFF THE PRESSES................22
DESKTOP PUBLISHING DIRECTORY......30

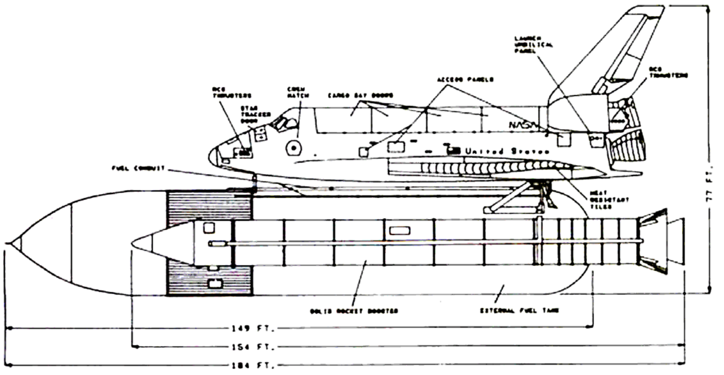
...which is today! As the graphical capabilities of computers increased, combined with the power of the Internet the World Wide Web was born. While initially extremely primitive in terms of design, advances such as CSS and Javascript / HTML 5 have led to an on-line world rich in sophisticated websites and content, a world that couldn't have existed without computers such as the Macintosh and those pioneers who risked their livelihoods by rushing headlong into the largely uncharted territory that was desktop publishing.

However, the web has not been kind to the print industry, with newspapers and magazines largely replaced by cheap or free on-line versions, those themselves preyed upon by content 'recyclers' who post slightly re-worded versions of articles on their own sites in the quest for advertising revenue. It's still uncertain how the print media industry is going to survive in the long term, and it ultimately may not survive at all, with the production of well-researched content moving exclusively to the domain of video.

Although bad for print media, the Internet has arguably improved access to information in general, a net benefit.

THE PRO SHOP

AUTOCAD



THE SPACE SHUTTLE DISCOVERY

Computers can be used to design more than just corporate logos and magazines! CAD (Computer Aided Drafting or Design) leverages the capabilities of computers to replace the tedious process of pencil-on-paper drafting.

No longer do iterations necessitate new drawings (or extensive erasure). Making a change is as simple as deleting or altering a line. You can recycle drawings into new ones, by reusing parts of a drawing, or combine parts from different drawings, for example floorplans or other repetitive designs. You can create templates to speed up new drawings. And when you're done you can print them using Postscript or another printing language to ensure the highest quality output, or e-mail them to whoever needs them, no pulp required.

CAD made a brave new world for drafting. But how did we get here?

In 1977, Michael Riddle started development on a program called Interact CAD. Interact ran on a minicomputer, a computer smaller than a mainframe computer but still designed to have multiple terminals connected to it, sharing its CPU and other resources. Interact did all of the calculations needed to create new drawings or change them, and with guaranteed accuracy.

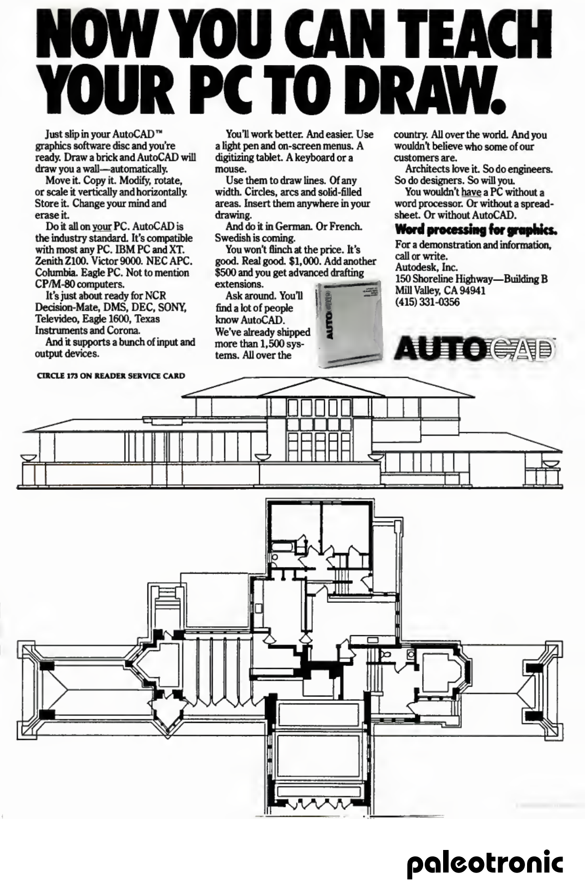
But minicomputers were quite expensive and out of the reach of most smaller drafting firms, which meant they were still stuck using a drafting desk and a t-square – as they had been for hundreds of years. In order to make Interact CAD more accessible, it needed to be able to run on microcomputers – personal computers.

Autodesk was founded in 1982 by Riddle, John Walker and 14 other co-founders. They intended to develop a number of 'automation' applications that streamlined aspects of various industries, hoping that one of them would take off. That turned out to be AutoCAD, a conversion (or 'port') of Interact CAD to the CP/M (Control Program for Microcomputers) computing platform.

CP/M was an operating system created in 1974 for Intel 8080 / 8085 processors running inside S-100 (or Altair) bus-based computers. The private use of CP/M computers by hobbyists was the impetus for the introduction of consumer-oriented 'personal' computers. But more importantly, CP/M and S-100 combined to make a standard method of designing and working with a computer, and this made software more portable.

Up until that time you typically had to compile software on a new computer, making changes to suit its particular methods of operation, and this typically had to be done by the software vendor, who was protective of their source code! But with CP/M, you could just send a customer a disk or tape.

COMPUTER AIDED DESIGN



NOW YOU CAN TEACH YOUR PC TO DRAW.

Just slip in your AutoCAD™ graphics software disc and you're ready. Draw a brick and AutoCAD will draw you a wall—automatically.

Move it. Copy it. Modify, rotate, or scale it vertically and horizontally. Store it. Change your mind and erase it.

Do it all on your PC. AutoCAD is the industry standard. It's compatible with most any PC. IBM PC and XT. Zenith Z100. Victor 9000. NEC APC. Columbia. Eagle PC. Not to mention CP/M-80 computers.

It's just about ready for NCR Decision-Mate, DMS, DEC, SONY, Televideo, Eagle 1600, Texas Instruments and Corona.

And it supports a bunch of input and output devices.

You'll work better. And easier. Use a light pen and on-screen menus. A digitizing tablet. A keyboard or a mouse.

Use them to draw lines. Of any width. Circles, arcs and solid-filled areas. Insert them anywhere in your drawing.

And do it in German. Or French. Swedish is coming.

You won't flinch at the price. It's good. Real good. $1,000. Add another $500 and you get advanced drafting extensions.

Ask around. You'll find a lot of people know AutoCAD. We've already shipped more than 1,500 systems. All over the country. All over the world. And you wouldn't believe who some of our customers are.

Architects love it. So do engineers. So do designers. So will you.

You wouldn't have a PC without a word processor. Or without a spreadsheet. Or without AutoCAD.

Word processing for graphics.

For a demonstration and information, call or write.

Autodesk, Inc.
150 Shoreline Highway—Building B
Mill Valley, CA 94941
(415) 331-0356

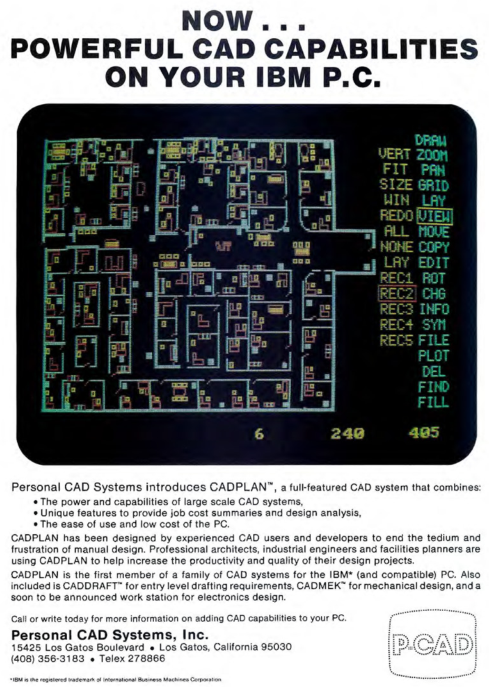
AUTOCAD

CIRCLE 173 ON READER SERVICE CARD

This meant that AutoCAD could be sold and installed much more cheaply than Interact CAD, and work on much cheaper hardware. This, combined with being the only player willing to take a risk in developing microcomputer software for the drafting market, led to AutoCAD's widespread adoption. By 1986, four years after its introduction, AutoCAD had overtaken all other CAD programs, running on mainframes, minicomputers or otherwise, to become the most used CAD application in the world.

It's a very good example of how personal computers could (and would) dramatically change an industry. It's also a very good example of how a niche market could become dominated by a single application – while engineering and architecture firms were happy to train their employees up on the first software package to show a benefit (and AutoCAD's benefits were enormous), they're far less likely to re-train up those employees on another package regardless of additional benefits (unless they are very substantial), which means the first package they buy is likely to be the one they stay with until they're forced to move to something else.

AutoCAD was that software. And Autodesk was here to stay.



NOW . . .
POWERFUL CAD CAPABILITIES
ON YOUR IBM P.C.

Personal CAD Systems introduces CADPLAN™, a full-featured CAD system that combines:

- The power and capabilities of large scale CAD systems,
- Unique features to provide job cost summaries and design analysis,
- The ease of use and low cost of the PC.

CADPLAN has been designed by experienced CAD users and developers to end the tedium and frustration of manual design. Professional architects, industrial engineers and facilities planners are using CADPLAN to help increase the productivity and quality of their design projects.

CADPLAN is the first member of a family of CAD systems for the IBM* (and compatible) PC. Also included is CADDRAFT™ for entry level drafting requirements, CADMEK™ for mechanical design, and a soon to be announced work station for electronics design.

Call or write today for more information on adding CAD capabilities to your PC.

Personal CAD Systems, Inc.
15425 Los Gatos Boulevard • Los Gatos, California 95030
(408) 356-3183 • Telex 278866

*IBM is the registered trademark of International Business Machines Corporation

Indeed, since Autodesk launched AutoCAD at the COMDEX trade show in Las Vegas in 1982, there have been 31 versions of the software, some running on MS-DOS, then Windows and then Macintosh. AutoCAD is used in construction, animation, architecure and more.

But while AutoCAD would rule the roost for decades to come, competitors still attempted to take a slice of its pie.

This Week

AutoCAD, a drafting and design package

By Kathy Chin, IW Staff

Autodesk, based in Mill Valley, California, claims that its new product, AutoCAD, is the lowest-priced two-dimensional drafting and design software package on the market.

The package lists at $1000 and is designed to be used as a general-purpose drawing tool, stressed company spokesman Mike Ford.

"It's not geared specifically for architects, but for anyone who draws." AutoCAD would be suitable for architectural and landscape drawing, mechanical, electrical, chemical and civil engineering and printed-circuit design. Ford noted that one sale went to a museum director who needed the product to redesign floor plans that must accommodate constantly changing art exhibitions.

According to Ford, prior to the introduction of AutoCAD, people paid $50,000 for programs that were designed for minicomputers. Although the features of AutoCAD are not as extensive as those of packages for minicomputers, its cost, plus the price of a microcomputer and plotter, adds up to less than $10,000.

"AutoCAD acts like a word processor for drawings," say company officials. The product allows users to draw lines of variable width, circles, arcs and solid forms. Run on 8-bit and 16-bit computers under CP/M-80, CP/M-86 or MS-DOS/PC-DOS, AutoCAD can create drawings with a light pen or digitizer or from the keyboard.

AutoCAD is configurable for the Victor 9000, the IBM PC and computers that run on CP/M-80. A UNIX version is currently under production. The system supports Summagraphics and Houston Instruments digitizer, and all Hewlett-Packard and Houston Instruments plotters.

For the time being, you can purchase AutoCAD through the company. Contact Autodesk, 16 St. Jude Road, Mill Valley, CA 94941; (415) 381-1819. ■

AutoCAD can run on a Victor 9000.

Computer-Aided Design: New Micro Application

By Sasha Lewis

Marshall McLuhan once said that human beings are the sex organs of machines. That is, humans create new machines since machines themselves are incapable of reproducing "after their own kind."

Computer-aided design (CAD) is changing all that; now computers are getting into the act of designing and creating new machines of all kinds. Soon microcomputers may make it possible for users to create new designs for computers, ICs, aircraft, textile designs and automobiles, among other and joysticks. Blum's program allows you to sketch a design in ten times as much detail as the basic Apple graphics system.

Each picture can contain from 1000 to 1500 lines. Although Blum has made input-resolution more precise, his hard-copy output is limited to the Integrated Data Systems dot-matrix printer, which outputs 84 dots per inch. This gives him only a crude hard copy. While the combination is of sufficient quality for Blum's applications, it is not the same as that of a plotter.

The Illustrator cannot produce camera-ready art for either circuit design or architectural plans. At this point in its development, it "is good for sketch-pad design," notes Blum, who uses it himself for cartooning and animation.

Logic-Design Systems

Spectrum Software, of Sunnyvale, California, is offering a package of logic-circuit design aids. The package includes two programs, a logic designer and a logic-circuit simulator to test designs. Both run on the Apple II, and the logic simulator can run on the Tandy TRS-80.

The logic designer, according to company president, Andy Thompson, finds its primary industrial use in "piecemeal design. The system's maximum capability is 1000 gates—about equivalent to medium MOS." Making the piecemeal design process more efficient "improves the turnaround time on IC design," said Thompson.

The logic-circuit simulator gives the designer printed network descriptions for documentation. Eventually, the entire circuit is designed and tested on a

continued on following page

However, no one ever came close to AutoCAD's market share. This was in part because computing publications loved AutoCAD: not only was Autodesk successful in getting a new industry to computerise, they also advertised a lot which didn't hurt.

Also, crucially perhaps, Autodesk also developed a good software package and supported it well, and there was no reason for anyone to go anywhere else.

AUTOCAD™
Number One

In November 1982, we introduced AutoCAD,™ the computer-aided design and drafting program for personal computers, and said that AutoCAD would become the standard for CAD worldwide.

By April 1985, we had shipped more than 20,000 copies of AutoCAD, making it the most widely installed and used computer aided design system in the world; micro, mini or mainframe.

When we developed AutoCAD, we believed that the personal computer would rapidly become the core of the engineering workstation—a general purpose tool which assists the engineer, architect, designer or drafter in all aspects of their work. We believed that AutoCAD could deliver mainframe CAD power as an essential part of this workstation. We believed that we could bring mainframe CAD to the personal computer without giving up the speed and accuracy which are the key reasons to use CAD in the first place. We believed that by making our system a fully open architecture and assisting others who wanted to build products around AutoCAD, hundreds of vertical market applications would be developed by those who shared our belief in the potentials of this market.

Very few took us seriously. They looked upon the personal computer as something which might be able to do word processing or pie charts, but not serious design. They believed that if CAD was done at all on the PC, it would be done with limited-functionality programs for specific applications; "serious, general purpose CAD will always remain the province of the mini and mainframe."

Now, tens of thousands of users have discovered that they can do serious, professional design work on personal computers. More than 1,300 dealers, systems houses, and OEMs worldwide have discovered that computer aided design isn't an esoteric product for the Fortune 500 companies, but an everyday tool as fundamental to people who draw as a word processor for people who write.

Our strategy to make AutoCAD the standard is working, and our commitment to this strategy never wavers. AutoCAD is continually being enhanced and upgraded; our newest release provides 3D visualization, curve fitting and a macro programming capability. AutoCAD runs on over 31 personal computers, with more being released on a continuing basis. Vertical market applications such as AE/CADD,™ the professional design tool for architects, add to AutoCAD-specific solutions for design professionals. CAD/camera,™ our expert-system based auto-vectorizing system converts paper drawings to CAD automatically, and at $3,000, costs less than 5% of the price of competitive systems. Our AutoCAD-to-mainframe translators allow integrating AutoCAD with large scale CAD systems including CADAM, Intergraph and Computervision. AutoCAD is available in French, German, Swedish and Italian editions, with Spanish and Japanese editions scheduled for release soon.

If your customers design or draw as part of their work, you owe it to yourself to see what has made AutoCAD the CAD standard in such a short time. If you sell personal computers, you already are dealing in the most expensive part of a professional CAD system. Just by adding the $2,500 AutoCAD software, your customers can immediately share the benefits that owners of million-dollar CAD systems have been enjoying for over a decade.

AutoCAD. Number one—for a lot of very good reasons.
See us at Comdex Booth #574

AUTOCAD™
AUTODESK, INC.
2320 MARINSHIP WAY
SAUSALITO, CA 94965
(415) 331-0356 or
(800) 443-0100 x406
TELEX 275946 ACAD UD

InfoWorld

Autocad Offers Impressive CAD Capabilities for Microcomputers

BY DON CRABB
REVIEW BOARD

Impressive. That's the word that comes to mind when considering the Autocad computer-aided drafting and design program from Autodesk Inc. We are impressed that a $2,500 (in its most complete version) program written for the IBM PC and compatibles could do the work of turnkey minicomputer-based systems costing thousands of dollars more.

Why does this feat so impress us? After all, the lowering of software prices across all kinds of product lines is the order of the day in the slumping microcomputer market. It impresses us because we have firsthand exp[illegible] on the design [illegible] of minicom- [illegible] system that Autocad hopes to displace. Such complex, highly specialized software is not easy to create. To do it on a

```
Command: VSLIDE
Slide file: 18
Command:
```

Autocad from Autodesk brings minicomputerlike computer-aided design capabilities to the microcomputer, legitimizing it as a serious drafting tool.

physical dimensions of the objects as well as their exact position within the standard Cartesian coordinate system. You can specify the absolute x,y coordinates of objects as well as their lengths and angles. Or you can use relative x,y positioning, so that the element is placed relative to the lo-

Once you've selected a new drawing or an existing one, the drawing editor screen is displayed. The majority of this screen is taken up by the drawing area. To the right of this is the menu bar, where you can highlight submenus of commands. Below the drawing area is space for direct typing

Advertisement for Scotch brand diskettes.

Heavy Duty

What use a computer on a sailing ship?

In 1983 Australia's Royal Perth Yacht Club challenged the New York Yacht Club to a race for the America's Cup, a sailing trophy that had been held by the the NYYC for the previous 132 years and 24 challenges.

With his yacht Australia II, businessman Alan Bond had finally found victory after three previous failed challenges between 1974 and 1980. For the first time, the America's Cup was no longer in the hands of the Americans, and they really wanted it back!

The next contest was scheduled for four years later, in 1987. Now that Australia had demonstrated it was possible to beat the Americans, a number of yachts from other countries opted to take a stab at it, including Canada, France, Italy, New Zealand and the United Kingdom – 25 yachts in all. This made for a really crowded field!

Contests to identify both a challenger and a defender were held. Ironically, Alan Bond's Australia IV lost the defender contest to Kookaburra III, placing Bond outside of an America's Cup regatta for the first time in thirteen years. But the challenger spot was won by Stars & Stripes 87, an American yacht skippered by Dennis Conner, who had skippered Liberty, the yacht that had lost to Australia II.

Conner did not want to lose twice.

The best-of-seven series of races was held off the coast of Fremantle, Western Australia from the 31st of January to the 4th of February 1987. It was a short series. Stars & Stripes 87 won every race. The Americans had regained the Cup. But how had they done it?

Technology had been playing an increasing role in the design of yachts into the 1980s; Australia II had won the 1983 contest in part due to its winged keel, a new design that had allowed it to have a very low centre of gravity that aided it while sailing upwind. Hulls made out of fiberglass were starting to make an appearance. And sails were being designed using computer programs.

Written in languages such as Turbo Pascal (as demonstrated in the advertisement below), these computer programs modelled the conditions faced by the competitors, mathematically calculating the ideal sail shape, which was then laser cut.

Conner wasn't going to make the mistake of thinking twice that seamanship would win the day. He would need to be creative with the design of the Stars & Stripes, spending two and a half years refining it, including its sails, building a fast ship designed for the strong winds off of Western Australia.

His efforts paid off, and the America's cup returned to America. Sailing was changed forever.

News from Borland International! Vol. 1 No. 2

How Borland is helping bring the America's Cup back to America!

"I think those who grasp the technology will prevail"

Bill Shore, President, Shore Sails Co., Newport, RI

Borland's Philippe Kahn at the helm of America's Cup challenger "Heart of America," with Shore Sails' President Bill Shore

"Sail-making is traditional—a craft—but I think we're huge steps ahead of the competition when we get involved with higher technology," says Shore.

He and Shore Sails' 17 different franchised sail lofts in the U.S. are in what Shore describes as a "highly competitive business, whether it's America's Cup racing or any race." And he adds, "You guys (Borland) do good stuff that's affordable, which is one of the reasons why we wrote all our sail design programs in Turbo Pascal.®"

"These days," he says, "there are many parts to a sail, and Turbo Pascal lets us arrange all the parts properly. We design what the garment industry calls a 'marker'—and rely on Turbo Pascal to do critical things like getting thread lines in the same direction as load lines.

We take the diskette to our new $250,000 laser cutter, which follows the Pascal program precisely, draws out the sail and cuts out the sail. We glue and sew and you've got the best there is."

"Heart of America" surfing downwind, Santa Cruz, California

"The wrong sails will sink your chances—if not your boat—so we wrote Turbo Pascal programs"

Win Fowler, Shore Sails Co., Portland, Maine.

The right sail design, at the right price, right now, has to happen in 17 different Shore Sails Lofts across America.

It had to happen with America's Cup challenger *Heart of America* which carries Shore sails—and it has to happen with the (currently) 700 different boats that Shore Sails has in their Turbo Database Toolbox.™

Sail design, sail pricing and "beating the handicapper" are all done at Shore Sails with Turbo Pascal.

In case you don't know the sharp end from the blunt end of a boat, the right sail design for any boat is more than design and price. It's tactical advantage. Designing sails that take the greatest advantage of the boat's basic design and rigging without getting stuck with a heavier-than-desirable Official Handicap. (Handicaps can eat your chances faster than a Great White.)

The "right sail" design bends but doesn't break the racing rules written by, amongst others, MORR (Midget Offshore Racing Rules) or IOR (International Offshore Rules). Turbo Pascal spills out "right sail" designs for Shore Sails so their customers tend to "handicap" the Rules Committee instead of the other way around.

Shore Sails' connection with Borland doesn't end with Turbo Pascal and our Database Toolbox.

Shore's Fowler has also written SuperKey® macros for "every file we have" and says, "We'd be lost without them."

He uses SideKick® to dial every phone call and SideKick's Notepad to communicate between all the Lofts, saying, "That way we don't need a word processor." Shore Sails also uses Turbo Lightning® and Reflex: The Analyst.®

So why so many Borland products in one company?

Win Fowler says, "We'd be sunk without them!"

"There is no second prize" Omar Bradley

Sail designs generated from Shore Sails' Turbo Pascal programs.

Borland's Instant Winner Game

Scratch this card now and you could instantly win 2 free round-trip airline tickets to Australia for the America's Cup Race!

First Prize ($10,000 value!) includes accommodations for two in Perth, Australia during the final America's Cup races, which start January 31, 1987. See America win it back after our *only* loss in 134 years! There's more than one *instant winner* in Borland's Instant Winner Game, because you could win one of two new $6,895 4-WD Suzuki Samurai convertibles, or a $4,995 AST TurboLaser™ printer, or a $4,499 Toshiba T3100,™ or a $2,399 Toshiba T1100™ Plus, or a $595 AST SixPakPremium™, or a $69.95 Traveling SideKick,® or ny one of hundreds of other Borland products—and at the very least a Borland Rebate Coupon, good for $10 off any single product or $15 off any bundled product offer!

See Official Rules on the back of this card for details.

There will be a second-chance drawing for the trip if not claimed by 12/30/86. There's also a second-chance drawing for the two Suzukis if not claimed
ll rebate coupons are good for products purchased 9/5/86-3/31/87. Product prices above are suggested list prices.

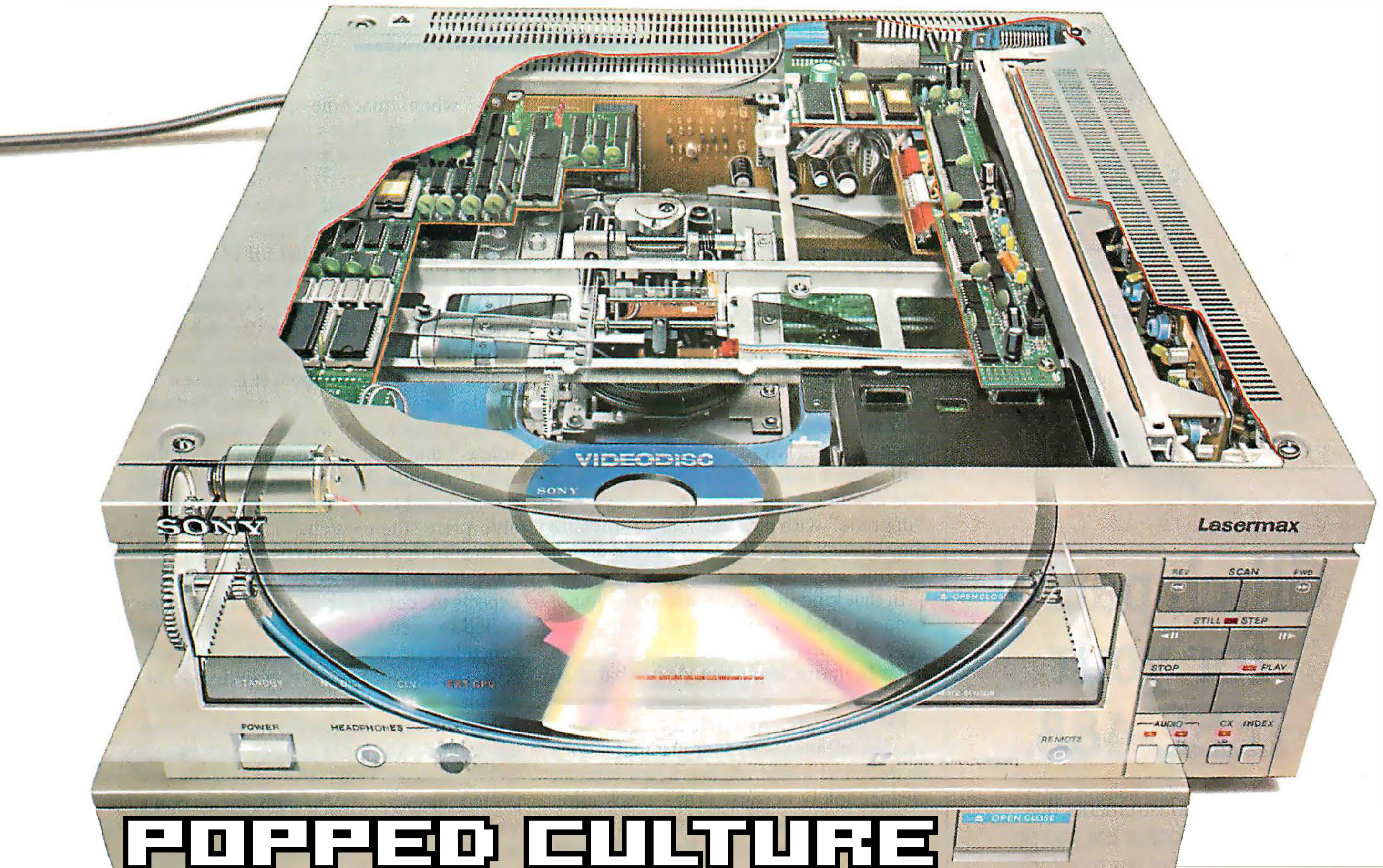
box to reveal whether
e or get a rebate coupon.
second-chance entry
t.

Second-Chance Sweepstakes Entry!

We're running two Second-Chance Sweepstakes drawings to award the trip and cars. They *will be won* by someone—it *could be you!* Fill in the entry coupon and mail it now. Winners will be notified immediately, because the final America's Cup races start in Australia on January 31, 1987, and you'll have to pack in a hurry.

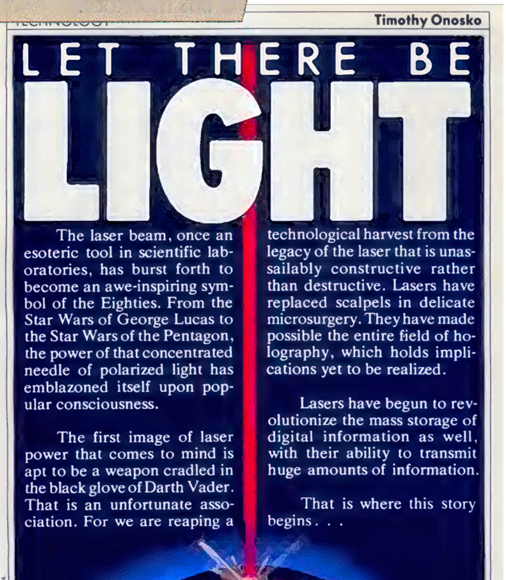
(You will need a valid passport and the ability to comprehend Australian versions of the English language.)

Name __________
Address __________
City __________
State _____ Zip _____



POPPED CULTURE

But lasers aren't just used for cutting sails. They're used in all sorts of applications, including in CD, DVD and BluRay players. However, before all of those there was LaserDisc. Efforts at optical video recording began in the 1950s, using a transparent disc. But it wasn't deemed to be commercially viable at the time. In 1969 Dutch manufacturer Philips was experimenting with optical disks when they discovered they had more success with a reflective disc. They partnered with American company MCA (which owned the transparent disc patents) to develop the LaserDisc system. They demonstrated a prototype in 1972, and the system went on sale in 1978, two years after the introduction of the VHS VCR and thus arguably two years too late to gain widespread popularity. Although LaserDisc's descendants, the CD and the DVD would be wildly successful, it was not, but the format did find an audience amongst those who wanted the highest video quality, which was unrivalled by tape-based competitors. LaserDisc also had another advantage VHS couldn't match: it could be used to make videogames.



Timothy Onosko

LET THERE BE LIGHT

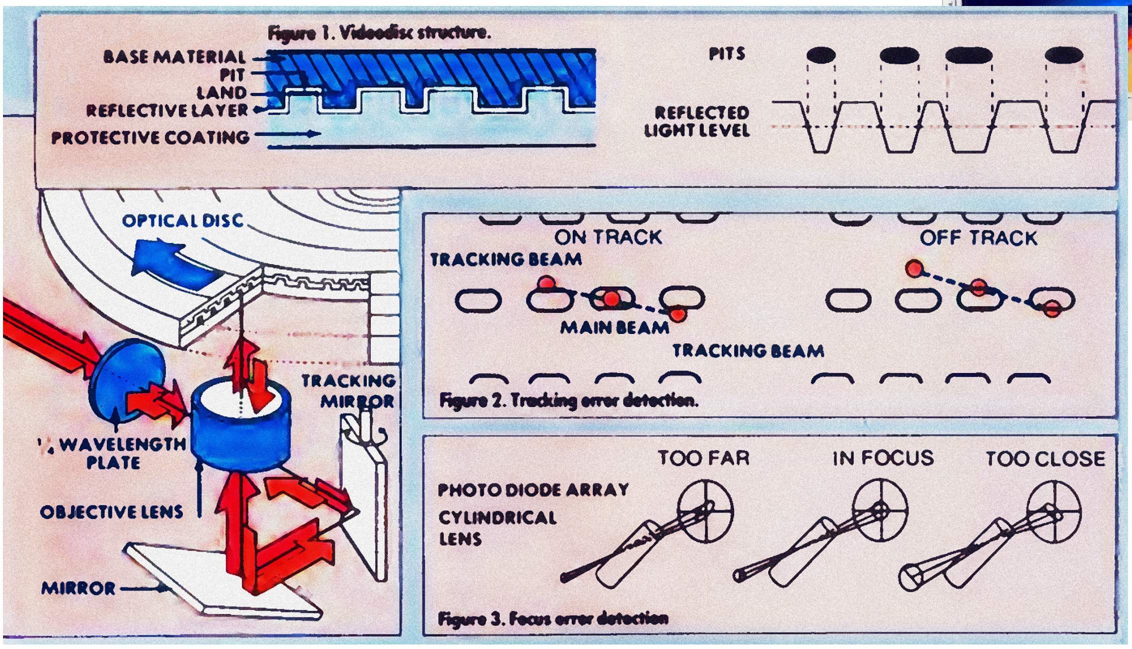
The laser beam, once an esoteric tool in scientific laboratories, has burst forth to become an awe-inspiring symbol of the Eighties. From the Star Wars of George Lucas to the Star Wars of the Pentagon, the power of that concentrated needle of polarized light has emblazoned itself upon popular consciousness.

The first image of laser power that comes to mind is apt to be a weapon cradled in the black glove of Darth Vader. That is an unfortunate association. For we are reaping a technological harvest from the legacy of the laser that is unassailably constructive rather than destructive. Lasers have replaced scalpels in delicate microsurgery. They have made possible the entire field of holography, which holds implications yet to be realized.

Lasers have begun to revolutionize the mass storage of digital information as well, with their ability to transmit huge amounts of information.

That is where this story begins. . .

VOLUME 11 NUMBER 9/CREATIVE COMPUTING 43



A laserdisc stores information in a similar way to a CD-ROM: a spiral track circles out from the centre of the disc, the track made up of 'lands' and 'pits', two levels of elevation. The lands are reflective, and the laser can detect a land or a pit based on whether or not the light bounces back. However, unlike CD-ROM the video signal on a laserdisc is encoded in analog, with varying widths of pits and lands making up a composite video signal with FM sound.

VIDEODISC GAMES TO HIT THE ARCADES THIS SUMMER

Get ready for a whole new gaming experience—interactive "minimovies." The first of these videodisc–video game hybrids should hit arcades sometime in midsummer, with home versions expected to follow in about a year. The latest attempt to boost the slumping game industry, interactive minimovies will combine the usual computer-generated game character, such as a spaceship or warrior, with live-action or animated backgrounds stored on a laser disc.

Several Hollywood film companies—Paramount, MCA-Universal, Don Bluth Productions, Columbia, Warner Bros., and Lucasfilm—hope to cash in on the multibillion-dollar gaming business, providing the ingredient they offer best: movies. The minimovie enables the production of superior graphics and increased story possibilities, as well as better advanced tie-ins between video games and theatrical films.

According to a spokesperson at Paramount, who has struck up a partnership with Sega, the added visual reality that comes from using videodiscs could even lead to the preproduction planning of footage for use in both the movie and the tie-in game.

rently previewing the Sega/Paramount laserdisc game *Astron Belt*. Developed by a Japanese firm, the game is reportedly doing "extremely well," having already scored a major success in Japanese and European arcades. Kids are lining up in droves just waiting to deposit their two tokens. *Astron Belt* features a computer-generated spaceship flying against a special-effects-created space background originally imaged on film stock.

According to Brenda Mutchnick of Sega Games, "We hope to release a few new games of this type by the end of the year. We don't know if *Astron Belt* will be one of them. Even though it's scored a major success in Japan, when we got a look at the game here we didn't feel the game play was as good as that of current home computer games. We are now redesigning the cabinet itself and are awaiting future software developments with our own titles."

Don Bluth Productions will unveil an interactive coin-op game—*Dragon's Lair*—sometime this summer. Created by Bluth and Advanced Microcomputer Systems (AMS), the new game will be marketed to arcades under the Starcom banner. The head of AMS,

---

THE LASERDISC AGE BEGINS

Don Bluth's Animation Leads the Way to a New Coin-Op World

By Mary Claire Blakeman

In some circles they call him the "new Walt Disney." But Don Bluth would rather be known for himself—an artist dedicated to quality film animation and the man who helped bring "Dirk the Daring" to life in the ground-breaking laserdisc video game, Dragon's Lair (July *Video Games*).

The Disney comparison, however, is probably inescapable since Bluth worked for the granddaddy of film animation for almost 10 years, contributing to such movies as *Sleeping Beauty* and *Pete's Dragon*. And anyone who's seen even a few seconds of Bluth's work on Dragon's Lair can hardly be blamed for measuring the richness, colors and action against the standards set by Disney.

The reason for this is due to the fact that Bluth is continuing the tradition of "classical" animation, which means the backgrounds of film sequences are painted in full detail and characters move fluidly and naturally. This classical approach accounts for some of the startling reactions to Dragon's Lair because today's game players tend to experience animation only in terms of the flat, stilted effects of Saturday morning cartoons. By contrast, the animation of Dragon's Lair appears three dimensional and life-like because of the meticulous work that has gone into the film production.

In fact, it was largely Bluth's commitment to this kind of classical animation which led him to break away from Disney in the late 1970's. Live-action feature films were over-shadowing animation at Disney, so, on September 13, 1979, (Bluth's birthday), he and animators Gary Goldman and John Pomeroy left the company to establish a firm of their own.

The trio had worked nights and weekends in Bluth's garage re-discovering some of the lost techniques of classical animation and after leaving Disney, they released one of the fruits of their labors, a short film called *Banjo*. Then, moving into offices in Studio City, Calif., Don Bluth Productions created the animated sequence of *Don't Walk Away* for the movie *Xanadu*. Eventually, Bluth got to work on his dream, a full-length classically animated film, *The Secret of NIMH*, which was released in 1982.

Around that time, Bluth started exploring ways to unite animation with computer technology in a popular form. *The Secret of NIMH*, with competitors such as *E.T.*, wasn't doing as well as expected at the box office, so when Rick Dyer approached Bluth with an idea for a video game, he was ready to hear about it. Dyer, president of Advanced Microcomputer Systems, had a dream of his own: A video game that would combine laserdisc and computer technology—a game that would become Dragon's Lair.

"He called it his fantasy machine," Gary Goldman recalls. "Originally, it was a slower, more intellectual game. He wanted our company involved because he liked the animation we did. So we started discussions about how to speed up the action to make it a popular arcade game."

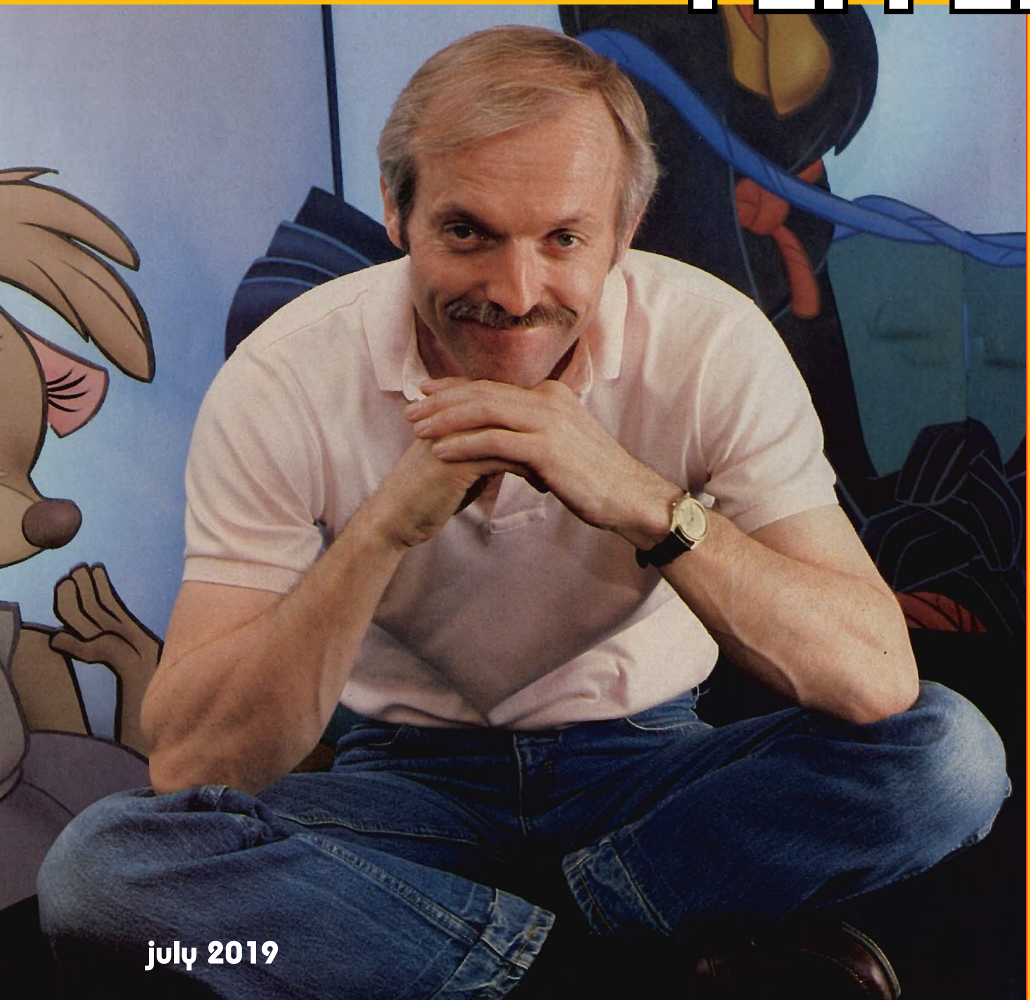
It took only about two weeks for Bluth and his associates to decide to join Dyer and the game manufacturing firm, Cinematronics, in creating Starcom, the holding company which released Dragon's Lair in July. With video games outgrossing movies, the decision was partially based on the economic reality that Dragon's Lair would solidify Bluth's financial position. Also, the animators were known as innovators and the chance to be in on the newest thing looked irresistible. But deeper than those obvious motivations, Bluth saw Dragon's Lair as an opportunity to build a new audience for animation, and video games as a way to nurture young animators.

"I thought it would be great if I could make a film and put it in front of an audience in an arcade," Bluth says. "And the games are a perfect training ground for young animators. They can take risks. They can experiment until they learn how to use the principles of animation. Then they can move into feature films."

John Pomeroy adds that the games

Art courtesy of Don Bluth Animation

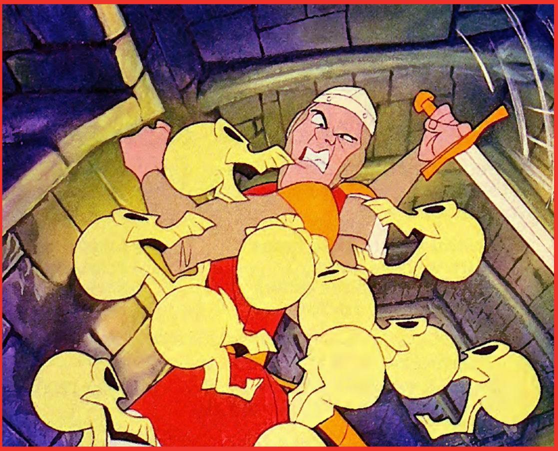
VIDEO GAMES 33



When animator Don Bluth agreed to animate an obscure laserdisc videogame tentatively titled "The Dragon's Lair", little did he know it would become one of his biggest successes...

DRAGON'S LAIR

Dragons Lair... Dragon's Lair... ah yes Dragon's Lair.



I remember that castle fantasy arcade game, the one that by 1986 when I first laid my eyes on it (in Australia), was always in the corner by itself and not many people playing it because it was more expensive than the 20c Galaga, Spy Hunter or Gyruss. Little did I know of the incredible story behind how Dragon's Lair came to be. As a young teenager playing arcade games, I only marvelled at its amazing graphics but also baulked at playing it because of the high price per game. It was inherently different from every other arcade game in every possible way at the time of it's release way back in 1983. Unlike every other pixelated sprite styled video game in the arcades, Dragon's Lair has a most fascinating history to uncover, it became an instantly famous arcade game in America due to its unique cartoon animated graphics as well as its intriguing but frustrating gameplay. Still to this very day, Dragon's Lair and its animated movie gameplay by Don Bluth are highly regarded in the history of video gaming. Its graphical style ventured into uncharted waters in a video gaming era where no one had ever seen or attempted to make an animated cartoon arcade game before. This the story of Dragon's Lair and the person behind its animation, Don Bluth, of how it all came to be.

For me it was strange to see an animated game in the arcades and stranger still that it was not put together by a known arcade coder, developer or distributor. A pimply faced teen who was playing the latest arcade games the likes of Out Run, Yie Ar Kung Fu and Space Harrier (I was brought up on Konami, Sega and Atari arcade gaming), I was completely unaware that Dragon's Lair had been a major arcade gaming success upon its release, even being hailed as the saviour to the now infamous and highly reported 1983 video gaming industry meltdown. In arcades across the United States, during 1983, Dragon's Lair had people queuing up outside the door just to play it. In a time when arcade video gaming was ruled by the likes of Frogger, Pac Man, Space Invaders and Pit Stop - Dragon's Lair created gaming history, it was dare I say it, quite a video gaming phenomenon, as game players looked in astonishment at its amazing movie animated graphical display.

As the first game at 50c per play it did not deter gamers, Newsweek captures the level of excitement displayed over the game stating "Dragon's Lair is this summer's hottest new toy: the first arcade game in the United States with a movie-quality image to go along with the action. The game has been devouring kids' coins at top speed since it appeared early in July. People waited all day in the crush at Castle Park without getting to play, It's the most awesome game I've ever seen in my life." By the end of 1983, Electronic Games and Electronic Fun were rating Dragon's Lair as the number one video arcade game in the USA, it received recognition as the most influential game of 1983, as regular computer graphics looked "rather elementary compared to Don Bluth's top-quality animation". By February of 1984, it was reported to have grossed over $32 million for arcade game distributor / publisher, Cinematronics.

Don Bluth wasn't an arcade game household name, so who was he exactly? Don had plied his trade as a film animator, film director, producer, writer and production designer. As a young child from El Paso,Texas, in the 1940's, he would ride his horse to the town movie theater to watch Disney films and is quoted as saying ,"Then I'd go home and copy every Disney comic book I could find". In the 1950's he gained employment at Disney as an assistant but left soon after and in the late 1960's he joined Filmation, working on layouts for The Archies. In the 1970's he found himself again at Disney working on cartoons such as Robin Hood, Winnie the Pooh and Tigger Too, The Rescuers and directing animation on Pete's Dragon.

ARCADE *Looks At*

E SHAPE OF GAMES TO COME

R GAMES

ms of action and adven-
be opened up by the
f laser-disc games in
l arcade.
are the days of one-
onal computer video
. Now you can play
mes against a backdrop
tars or blast around a
e track while sitting
the confines of an
achine.
games will revolutionise
ing arcade industry if
s to the several
on show at a recent
f what's new for '84 are
to go by.
already mentioned
nes in these pages —
we can also bring you
f what you can expect
ou'll be amazed — be-

gan with Seag's Astron
ready in action in some
around the country. It
in control of a video-
ship blasting through
eated by images stored
ser-disc.
ght alien ships, fly
dangerous rocky can-
ck alien ground bases
rious planets — and it
as if you are watching
on TV and not playing
e game at all! Astron
has another added-
the Vibra-Seat! If you
lien ship out of the sky
shakes just as if you
ght up in the backwash
explosion. Quite an
ce!
ing a similar space
Inter-Stellar from Funai.
es you a[illegible]s [illegible]nge
erts on l[illegible]anet and
against fle[illegible] of alien
ter-Stellar uses more

computer-style graphics than Astron Belt and is therefore not quite so stunning as its predecessor — but is still a good game nonetheless.

Moving back to earth Taito have entered the laser-disc race with a Grand Prix racing game called Laser Grand Prix.

A video car is superimposed on film of the Japanese Mount Fuji international race track.

You race against other video cars in an extremely realistic simulation of a formula one race. The roar of the engine and squeal of tortured tyres as you attempt to take the bends at top speed all add to the illusion.

The games' opening demo is pretty neat too — with the video car being transformed into a real race car as it streaks over the start line.

Laser Grand Prix also features bonus screens for winners — like the Spark Race, a night driving challenge and the Fantastic Race, a trip into the realms of fantasy still in the seat of a race car. The game comes in a large car cockpit type cabinet — so you won't miss it if one arrives in your local arcade!

However, the undoubted star turn of laser games at the moment has got to be Dragon's Lair — a fully animated sword and sorcery adventure with a touch of Tom and Jerry thrown in for good measure.

Dragon's Lair is the story of Dirk the Daring, a brave knight who faces many trials and tribulations in his quest to rescue a beautiful maiden from the clutches of a fire-breathing Dragon.

You control the actions of Dirk the Daring and attempt to keep him alive in his struggles against evil wizards, giant black riders, deadly bugs, monsters and much much more. Dirk can face up to 600 different challenges in 40 different locations before he gets to the dragon — but you will have to spend a lot of cash to see them all!

The controls are fairly simple — a joystick moves Dirk backwards and fordwards while "action" and "sword" buttons control those aspects of the game.

You have to use the controls at precisely the right moment — or Kirk will die an agonising — but often amusing — death.

And all this action is presented in cartoon style visuals. It's just as if you were watching a Disney cartoon adventure on TV — except that you are in control of what happens next.

WHAT'S NEW DO-BE-DO-BE-DO!

MR DO'S CASTLE

Mr Do! was tremendously popular in arcades and now has a follow-up. Mr Do's Castle is the continuation of his adventures.

Mr Do has to exterminate unicorns invading his castle. He does this by dropping a block with a hammer which knocks unicorns into a hole, or more simply by dropping a block on top of the beasts.

Mr Do can gain extra power from blocks marked with a death's head. This exterminates several unicorns at one attempt. Otherwise Mr Do has to avoid the pursuing unicorns by pulling up ladders behind him as he moves around the screen.

Bonuses are provided by dropping three blocks marked with keys which brings a shield into the highest window of the castle. If Mr Do can wipe out the shield the unicorns change into "EXTRA" and by wiping out the "EXTRA" with a hammer or by dropping on it, a flag runs up a pole. Run up five flags and another Mr Do appears.

At this stage of the game — continually more challenging — the final unicorn changes into several blue unicorns which are faster and more ferocious and if Mr Do survives them for 30 seconds they change into double unicorns and it takes a very skilled player indeed to survive their attack.

PUTER & VIDEO GAMES

by George Bachaelor

POPPED CULTURE

First, let's take a quick look at the technology behind the games themselves. While every other arcade game had microchips on a board, Dragon's Lair, published by Cinematronics in 1983 was primarily powered by a few rom chips and at the heart of the machine and the game was a Pioneer, Laserdisc, (model PR7820 and other Pioneer models after that). Technically it was far superior and ahead of its time, but not an acceptable or a well known format that the average arcade gaming punter may have realised was inside the arcade machine they were playing.

How did this all play out you ask? You have to go back to 1958 when Optical Video Recording technology, using a transparent disc, was invented by David Paul Gregg and James Russell. The technology was patented in 1961 and from there MCA bought the patents. In 1969, the Philips company developed a videodisc with a reflective mode having advantages over MCA's transparent disc, so MCA and Philips combined their efforts and first publicly demonstrated the video disc in 1972. In 1978 the analogue LaserDisc was first available commercially in Atlanta, Georgia, showcasing movies like Jaws, two years after the introduction of the VHS VCR, and four years before the introduction of the CD (which is based on laser disc technology). Pioneer Electronics later purchased the majority stake in the Laserdisc format and that's why there's a Pioneer Laserdisc powering Dragon's Lair as well as the Space Ace arcade video games (and possibly most other arcade LaserDisc games).

Arcade gaming up until 1983 had essentially been limited to pretty standard hardware capabilities. Coders and graphical artists were severely restricted in what they could portray on a video arcade game screen. According to my research in 1983, the very first LaserDisc video game was Sega's shoot 'em up, called Astron Belt but it had very little fanfare or is given the credit as being the first ever laserdisc arcade game. As history has shown, later that same year, laserdisc arcade gaming was taken by storm as Dragon's Lair was released, capable of better audio, better graphics, better resolution and able to store as well as access game information directly from a huge sized 20 centimetre disc.

The main disadvantages to Laserdisc gaming was that gameplay was often harder with the playing control mechanism used often very frustrating in comparison to existing arcade games. The laserdisc players while of high quality were not designed for the long use of arcade gaming in mind, there would often be momentary lags of a few seconds while playing the game as the laser disc was being read and the life of the the actual Laser Disc machine was limited and could fail quite easily often requiring costly repairs or replacement.

Where Don Bluth came in as animator of Dragon's Lair and later Space Ace, was as one would say "a bit out of left field". Rick Dyer, the then President of Advanced Microcomputer Systems, had failed to get his so called 'Fantasy Machine' invention off the ground, it was unfortunately a spectacular failure, however it did demonstrate that still images and narration could be stored and accessed from a video disc with a graphic adventure game he had devised, called The Secrets of the Lost Woods. After having watched a Don Bluth animated movie - The Secret of Nimh, Rick Dyer realized he needed 2D animation, an action script and sounds to bring excitement to his game which would lead to the development of Dragon's Lair. Originally he had created Dragon's Lair for home computers but he had no way of marketing his idea onto the home computer and console market. So he contacted Don Bluth to make his animated videogame dream a reality.

In an interview from the 1980's (found on Youtube), Don Bluth explains the project synopsis and design of how the concept of Dragons Lair was envisaged:

Lasers ACTIO

As you've probably guessed by now it's very hard to do Dragon's Lair justice by simply writing about it. It's definitely a game that has to be seen to be believed! That's where our pictures will help.

Dragon's Lair comes from Starcom, a division of Advanced Microcomputer Systems, the video game company whose Space Wars machine set the scene for the sci-fi arcade game boom in the late 1970s.

The company who created the amazing animation for Dragon's Lair strangely wish to remain anonymous — but American sources say that it is the work of Don Bluth who was behind the animated feature film *The Secret of Nimh*.

One and a half million dollars was spent on software alone for Dragon's Lair — $250,000 is the usual development budget for a video game. So that's why you are going to have to fork out more of those 10 pence pieces to play the game.

But before we go too wild about Dragon's Lair it does have its drawbacks — the price to play being the first.

It's going to be a difficult game to learn too — adding to the expense.

On the technical side — when you switch from location to location or situation to situation, there is a nasty glitch on the screen, just like when you change channels on your TV. This is caused by the speed of the laser scanning the disc — it simply isn't fast enough. Yet!

A way around this would be to use two discs tied into the machine's computer memory. But this would again add to the cost.

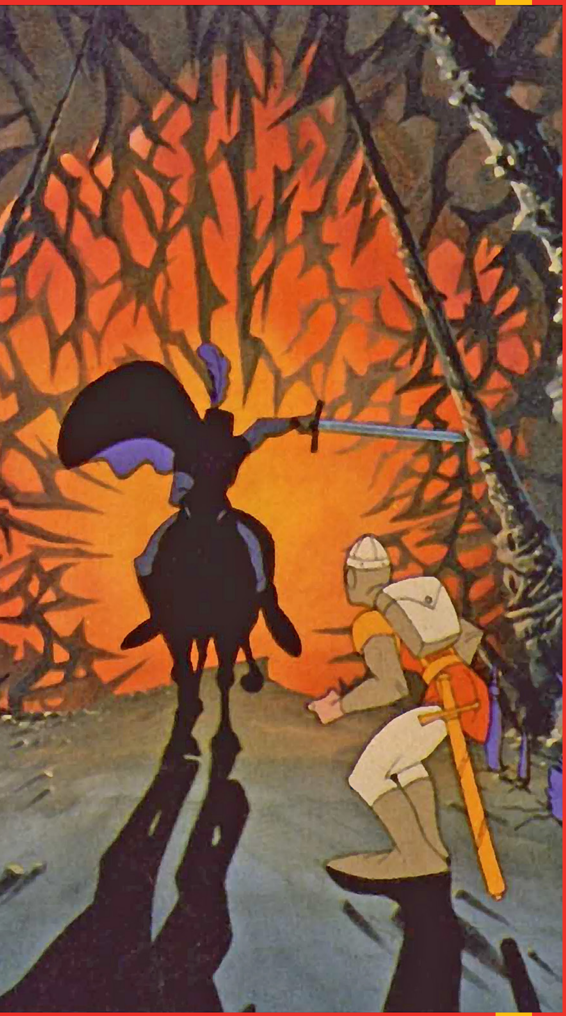
Having said that Dragon's Lair is still a big jump in games technology. And, so say the experts, there's much more to come.

Victor Penman, the man who watched over the creation of Dragon's Lair reckons that the next generation of games will involve other senses — smell, touch and possibly taste to enhance realism of the games. We'll just have to wait and see!

A new Dragon's Lair style game is due in the Spring.

Another sword and sorcery theme laser game is called Eon and the Time Tunnel in which the player travels through a mo landscape of dark mysterio

castles
C&VG h
this one
first to h
Rumo
through
film cre
Grand C
tion sp
working
for forth
It's o
fore this
a switch
ket. It
machine
selling
adaptat
with pop
ted with
You m
an arca
home —
simply s
And t
of linkin
disc tec
seem e
Make
disc w
playing
years. N
have to l
or becor
stead!
It all
ago tha
aliens
screens
announ
video ag
of the la



"First of all you have to give the illusion that the game player is in control when indeed he may not be, but you must give that illusion. I thought, 'Wow, that's right up our alley; that's movie making.' Give the illusion, present a moment to him in which he must react to a moment of danger and then get him to react to that moment at the right moment and then we'll see another scene which he is saved from that... I thought, 'That's very interesting, how can I design a game which will present enough of those moments in short little periods of time to where the game becomes exciting?' That was the challenge of the game".

As an independent entity, and on a shoestring budget of US$1 million, when Don Bluth and his studio took up the animation of arcade game Dragon's Lair, seven months later it was finished. An astonishing feat considering the amount of work involved. Statistically speaking, 13 animators were required to sketch 50,000 drawings of game characters in action. 24 drawings required for each second on screen. Drawings were transferred onto plastic sheets otherwise called cells and had to then be painted which also included drawing and painting of the backgrounds. Special effects such as raging fires, crumbling walls and deadly vapours had to be drawn and painted and were included in the game as danger signals to the player. All of the cells were combined and photographed one frame at a time. 1440 frames for each minute of completed scenes. Dialogue, sound effects and a musical score were then added before it was all transferred and stored onto a Laserdisc as the finished animated movie game.

Not being a global corporate conglomerate like Disney, Don Bluth's production couldn't afford to hire any models, or professional actors so the animators used photos from Playboy magazines for inspiration to draw the character Princess Daphne. They also used their own voices for all the Dragon's Lair characters, to reduce costs. One professional voice actor does feature - Michael Rye, as the narrator in the attract sequence, he is also the narrator for Space Ace and Dragon's Lair II.

The voice of Princess Daphne was portrayed by Vera Lanpher, who was head of the Clean-up Department at the time. Dirk, the main characters voice belongs to film editor Dan Molina, (who later went on to perform the bubbling sound effects for another animated character, Fish Out of Water, from 2005's Disney film Chicken Little).

The original Dragon's Lair, USA 1983, arcade game cabinets used a single side NTSC laserdisc, on the other side of the disc it was metal backed to prevent bending. European versions of the game were manufactured by Atari under license and used a single side PAL disc manufactured by Philips (not metal backed). Dragon's Lair and Space Ace arcade games in Europe were different in cabinet design to that of the Cinematronics version in the USA. A LED digital scoring panel was replaced with an on screen scoring display appearing after each level and the Atari branding was present in various places over the machine. It also came with the cone LED player start button not seen on the USA cabinets.

While the cartoon animation stored on Laser Disc was arcade gaming eye candy, the concept and gameplay meant you actually had the power of decision making. Dragon's Lair and Space Ace games, are also known as the first true interactive movie games, back then they called it "participatory video entertainment". In Dragon's Lair, you do not control Dirk, rather you direct him in what to do. The player decides to make a correct or incorrect move with the joystick which would determine the outcome of the game. This was done by areas on the laserdisc being accessed according to which joystick control command was given. The game has 38 to 42 different episodes with over 1,000 life-and-death

situations and over 200 different decisions to make. It has been confirmed from a video taped game that it only takes about 12 minutes to complete the game if you know all the moves.

The object of Dragons Lair was that old plot of saving the damsel in distress. You played Dirk the Daring, a knight who has to reach The Dragon's Lair inside a vast castle, slay Singe the dragon and rescue Daphne, the Princess. Once you complete the task, the game, the quest and the story are all over because there are no higher levels of difficulty. Basically, there is really no reason to obtain a high score, even though points are scored based on how far you can get and how well you can do.

Contrary to popular belief, both Dragon's Lair and Space Ace did contain diagonal movements. In some cases, these movements were simply the combination of two acceptable moves, while in other cases the diagonal move was distinct (for example, during the whirlpool segment, moving to the right or left is acceptable, moving diagonal up-right or up-left is acceptable, but simply moving up results in death). In all cases, the diagonal moves were optional, and there was always a 4-way alternative. Because of the Laser Disc format, movement during the game had to happen in a split-second. The game jumped between scenes depending on the success or failure of the player. It was an impressive feat for the time, but made for frustrating gameplay.

Between the USA and European versions certain scenes were not shown or played, including the drawbridge, the "Ye Boulders" sign before the rapids, and the scene after the battle against the Knight. European release of Dragon's Lair showed all the scenes played in the order they are stored on the laserdisc, and the game started on the drawbridge scene but that was cut from the North American version.

Due to the success of Dragon's Lair, Don Bluth and Rick Dyer teamed up again releasing Space Ace. It too used the laserdisc technology and animated cartoon story like gameplay and was found in arcades just 4 months later. Once again the player was required to move the joystick or press the fire button at key moments in the animated sequences to govern the hero's actions. However, the game's action was more varied with the player occasionally given the temporary option to either have the character he is controlling transform back into his adult form, or remain as a boy with different styles of challenges. Like Dragon's Lair, Space Ace is composed of numerous individual scenes, which require the player to move the joystick in the right direction or press the fire button at the right moment to avoid the various hazards that hero Dexter / Ace faces. Space Ace introduced a few gameplay enhancements, most notably selectable skill levels and multiple paths through several of the scenes. At the start of the game the player could select one of three skill levels; "Cadet", "Captain" or "Space Ace" for easy, medium and hard respectively; only by choosing the toughest skill level could the player see all the sequences in the game (only around half the scenes are played on the easiest setting).

A number of the scenes had "multiple choice" moments when the player could choose how to act, sometimes by choosing which way to turn in a passageway, or by choosing whether or not to react to the on-screen "ENERGIZE" message and transform back into Ace. Most scenes also have separate, horizontally flipped versions. Dexter usually progresses through scenes by avoiding obstacles and enemies, but Ace goes on the offensive, attacking enemies rather than running away; although Dexter does occasionally have to use his pistol on enemies when it is necessary to advance. An example can be seen in the first scene of the game, when Dexter is escaping from Borf's robot drones. If the

SPACE ACE

player presses the fire button at the right moment, Dexter transforms temporarily into Ace and can fight them, whereas if the player chooses to stay as Dexter the robots' drill attacks must be dodged instead.

Space Ace was made available to distributors in two different formats; a dedicated cabinet, and a conversion kit that could be used to turn an existing arcade cabinet of Dragon's Lair into a Space Ace game. Early version #1 production units of the dedicated Space Ace game were actually issued in Dragon's Lair style cabinets. The latter version #2 dedicated Space Ace units came in a different, inverted style cabinet. The conversion kit included the Space Ace laserdisc, new EPROMs containing the game program, an additional circuit board to add the skill level buttons, and replacement artwork for the cabinet. The game originally used the Pioneer LD-V1000 or PR-7820 laserdisc players, but an adaptor kit now exists to allow Sony LDP series players to be used as replacements if the original laser disc player is no longer functional.

Don Bluth animated three Laser Disc arcade games - Dragon's Lair, Space Ace and Dragon's Lair II: Time Warp. Even though Dragon's Lair had been a tremendous arcade gaming success story at first release and would eventually be the forerunner of CD-ROM gaming on home computers, by the middle of 1984 however, after Space Ace, popularity of both these games declined rapidly. Other competitors during the peak arcade gaming years ventured into cartoon animated story games on Laser Disc, but their success would not reach the high peaks of Dragon's Lair.

However, the Dragon's Lair legacy continues to live on many years after its arcade gaming demise. In 1986, Publisher, Software Projects, brought Dragon's Lair to the home computer. The Laser Disc animated tech just could not be replicated to any high standard on 8-Bit computer systems like the Amstrad CPC, ZX Spectrum and Commodore 64.

While the graphics is the main feature of the arcade game, the cartoon graphics were just not possible on 8-Bit home computers of the time. Graphically they were poor adaptations of the original arcade game, there was no Don Bluth doing the artwork or a team of animators, so it was just never going to be graphically outstanding or have the animation of the arcade game. The 8-bit versions had very poor graphics and only about 8 or 9 separate levels to play in comparison to the arcade game. There are very contrasting reviews of the game on 8-Bit platforms. ZZAP!64, issue 17, seemed to be forgiving of the difficulties of converting a laser disc game to the Commodore 64, giving it an overall score of 69%. They stated the graphics varied between average and very good, but one look and you can see they were being a tad optimistic. Lemon64 forum members are much more scathing in their comments about the C64 conversion, stating that "is was frustrating as hell and very high on difficulty". In issue 62 of C+VG, they were less forgiving in their assessment of the spectrum conversion, giving it 6 out of 10 for graphics and 3 out of 10 for playability. Amstrad Action, issue 20, gave the CPC version an overall of 67%, stating that "i find it frustrating to the point of insanity". The home computer game has so many drawbacks such as always dying an early death and always having to restart from the beginning no matter how far you have progressed as well as the dreaded multi load from tape, meant players got sick of the game fairly quickly.

In 1989, video game publisher, Readysoft, released Dragon's Lair onto the Commodore Amiga. To play the game required 1MB of memory and it consisted of 130 compressed megabytes stored onto six double sided discs, costing a whopping 44.95 pounds sterling. This was seen by many at the time as off putting to gamers and reviewers but the result of its graphics and sounds were simply amazing. The digitized graphics and sounds of the Commodore Amiga version of Dragon's Lair are by far the best of any home computer version, ACE magazine (April 1989) describing it as "aural and visual excellence". Although it was not the animated cartoon like the original arcade game, it was the best looking comparison to the arcade game, showing off the amazing capabilities of the Commodore Amiga. Critics either loved or absolutely hated the game - ST AMIGA Format magazine (March 1989) gave it an overall score of 92% stating

“the animation is spell binding. It’s the sort of thing that programmers would gaze at in awe. The characters are animated so smoothly and with accurately moving limbs that you won’t know that you’re not watching a conventional cartoon”. It has “an extraordinary resemblance to the original arcade game. Sound is fairly extensive as well with atmospheric background effects and a range of squeals and screams”. While Commodore User Amiga magazine (March 1989) gave it an overall score of 32%, praising its graphics with a 97% rating and giving its sounds an 80% rating, but it was scathing of its gameplay slating its playability and fun factor giving it just 19%. Reviewer, Mark Heley stated “Dragon’s Lair is an an amazing achievement but who wants to buy an amazing achievement. I’d rather have a game if it’s all the same to you.”

In 1987, Software Projects released an unofficial sequel on Amstrad CPC, Commodore 64 and ZX Spectrum home computers, called Dragon’s lair II: Escape from Singe’s Castle. In 1990, Readysoft once again released the game for the Amiga. The release of Dragon’s Lair on home computers had not been a full conversion of the whole arcade game, understandably due to memory constraints, so the unofficial sequel that is Escape From Singe’s Castle includes many of those parts left out. The plot this time though is that Dirk the Daring has returned to the Dragon’s Lair to claim a pot of gold (you save Daphne again in the 16 bit Amiga version). Once again, Singe has laid traps throughout his lair, forcing you to guide Dirk across a number of differently themed screens throughout eight levels to steal the gold and finally escape the clutches of the dragon. Once again the controls are awkward and the game high on difficulty. The graphics appear no different but there is more sound and it is rather annoying to the point of you having to turn the sound off, as it is unbearable. The Amiga version of the sequel is once again graphically impressive with lovely sounds but the Amiga gaming community is divided over its ratings - user MCMXC described it on Lemon Amiga “Compared to the first conversion, it is a HUGE improvement: faster load, many options (Including the indication of the moves), multitasking if enough memory available, saving positions and, if got a Hard Disk and the original first game, the possibility of install both of them making one single big game! A very good work! ”. However, user Mailman wrote of the sequel on the Amiga, “Serie of the games which are barely playable but full of absolutely amazing graphics (especially when you bear in mind that the conversion was done in years of ECS chipset domination). Nevertheless, seeing does not mean having good fun. Games are not only difficult but also stupid, boring and irritating. Very poor. This is a bit enhanced version of Dragon’s Lair”.

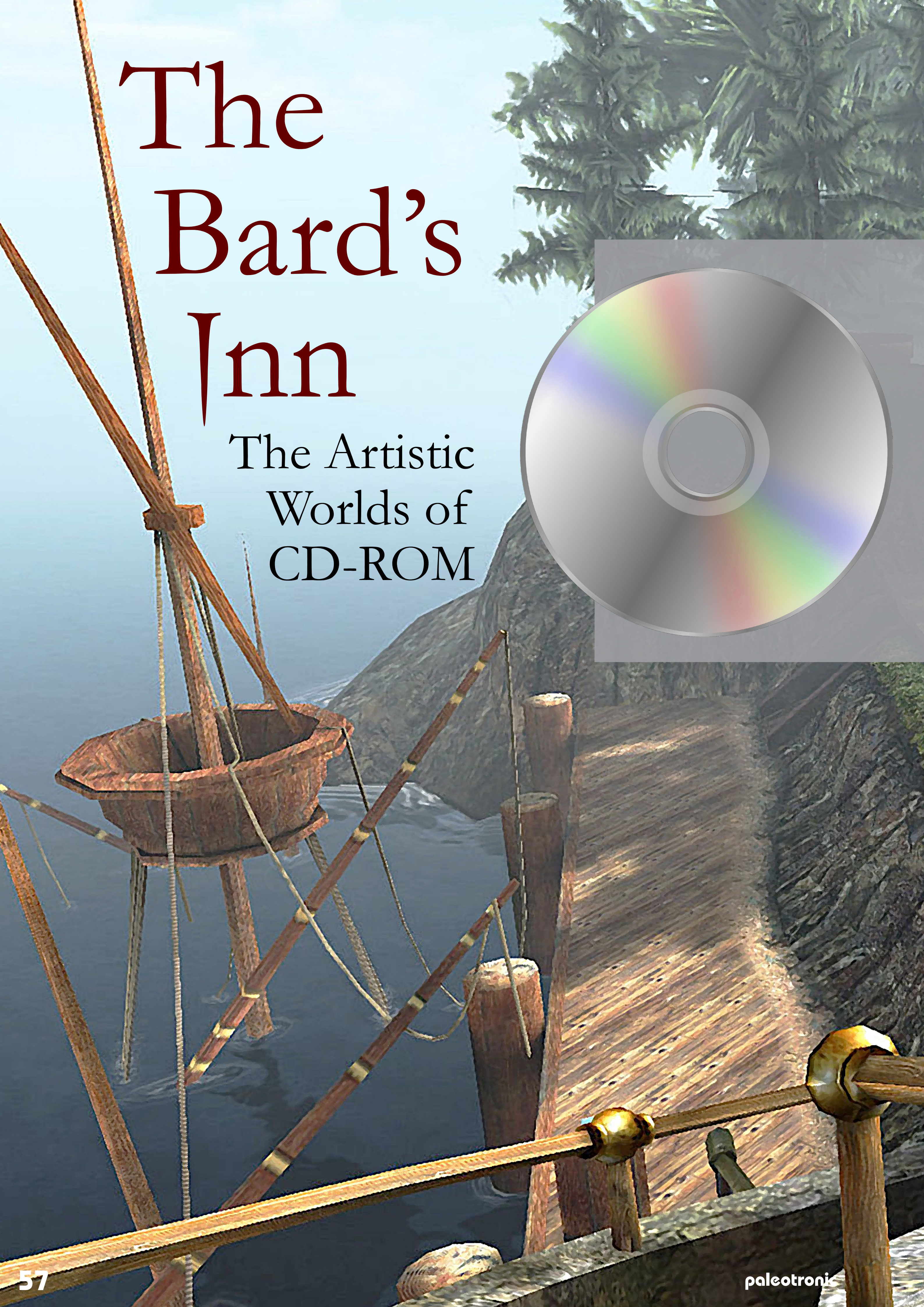
The third official Don Bluth arcade game, Dragon’s Lair II: Time Warp, was released in the arcades in 1991. It was the first true sequel and released eight years after the original Dragon’s Lair arcade game. Graphically brilliant with superb animation sequences it was once again hampered by a poor control mechanism that plagued the other Don Bluth laserdisc games - Dragon’s Lair and Space Ace.

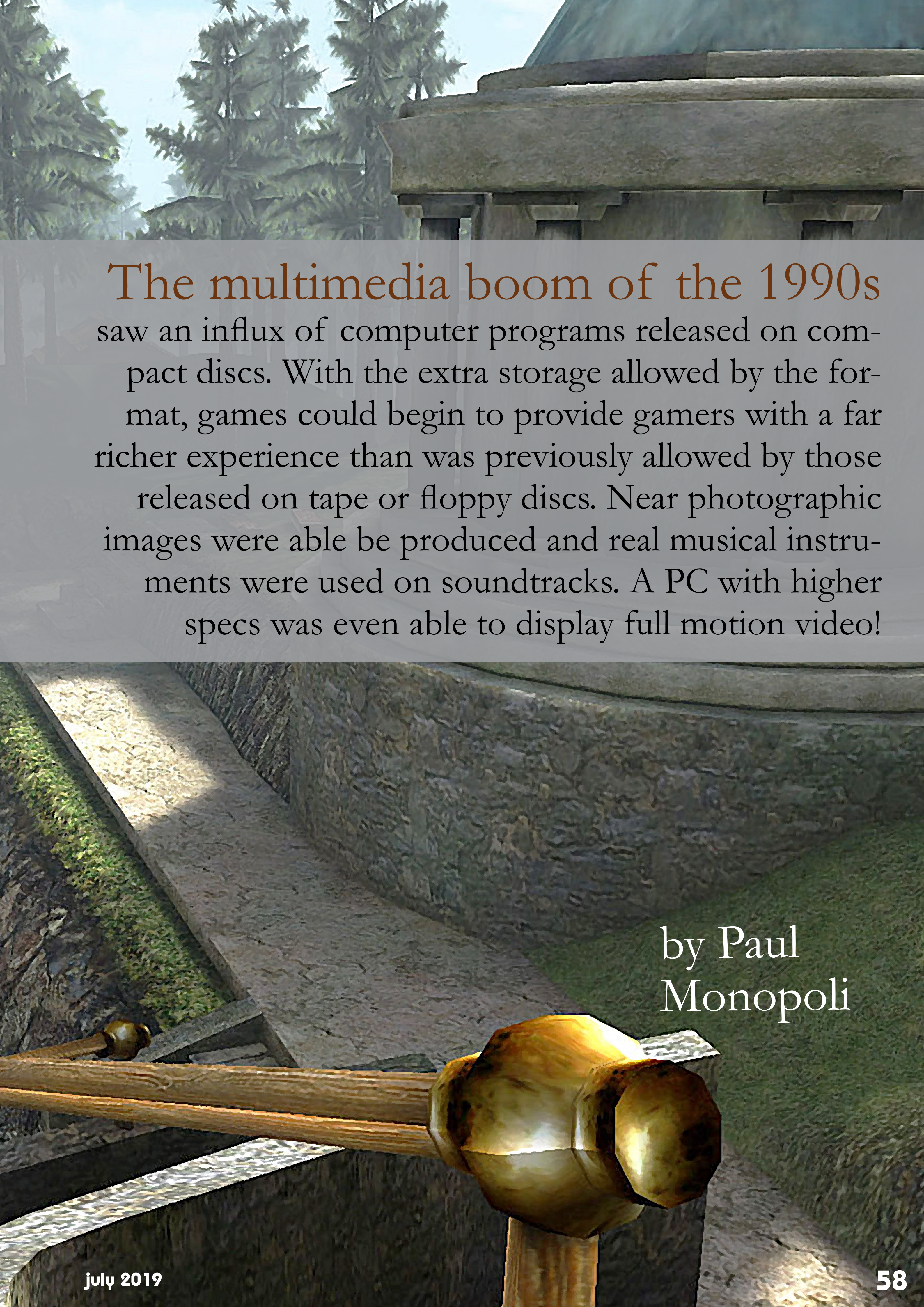
Another sequel Dragon’s Lair III: The Curse of Mordread was made for Amiga and DOS in 1993, mixing original footage with scenes from Time Warp that were not included in the original PC release due to memory constraints. The game also included a newly produced “Blackbeard the Pirate” stage that was originally intended to be in the arcade game but was never completed.

So you want to play Laser Disc games like Dragon’s Lair and Space Ace ? Well there’s an emulator for that, it’s called DAPHNE (how appropriately named and cool). The DAPHNE laserdisc emulator is free allowing you to play arcade laser disc quality games on your PC. Dragons’s Lair and Space Ace are there, but did you know there were a stack of laserdisc arcade games released throughout the 1980’s and 1990’s? Well Daphne emulator allows you to play almost all of them! Arcade laserdisc games you can play using Daphne include Astron Belt, Badlands, Bega’s Battle, Cliff Hanger, Cobra Command (running on Astron Belt hardware), Dragon’s Lair (US), Dragon’s Lair II, Esh’s Aurunmilla, Galaxy Ranger, Goal to Go (running on Cliff Hanger hardware), Interstellar, M.A.C.H. 3, Road Blaster, Space Ace (US), Star Blazer, Super Don Quix-ote, Thayer’s Quest and Us vs Them. DAPHNE is developed by Matt Ownby, the latest version being 1.0.12. It runs on Windows, Linux and MacOS. It is a closed-source, multi-arcade LaserDisc emulator. It is also available as a libretro core. You can also use MAME to emulate arcade laser disc games the main differences between MAME and DAPHNE are that DAPHNE is the primary emulator for LaserDisc arcade games and supports many more games than MAME. You can use the DaphneLoader to update DAPHNE and auto download games. MAME supports six LaserDisc games and two that DAPHNE doesn’t support - Cube Quest and Firefox.

The Bard's Inn

The Artistic Worlds of CD-ROM





The multimedia boom of the 1990s

saw an influx of computer programs released on compact discs. With the extra storage allowed by the format, games could begin to provide gamers with a far richer experience than was previously allowed by those released on tape or floppy discs. Near photographic images were able be produced and real musical instruments were used on soundtracks. A PC with higher specs was even able to display full motion video!

by Paul Monopoli

Myst was a tour de force that started a franchise.

MYST

A lot of games released on CD were rehashes of their existing floppy disc releases, with few offering any advantagesother than having the game on a single piece of media. However, there were many that took full advantage of the the new format and, to this day, remain impressive pieces of software.

While Microsoft were developing the Encarta Encyclopaedia for adopters of CD-ROM drives, Rand and Robyn Miller were looking to use the format to entertain. The end result, Myst, was both a game and an experience for the player. Originally conceived as an interactive children's book, this piece of graphical splendour would be remade and enhanced once Myst had made its mark on the public.

The brothers already had the distinction of releasing the first ever PC CD-ROM game, The Manhole in 1989. The Manhole impressed the magazines at the time and the brothers continued to improve their world building skills with each game that followed. In 1993 Myst was released and everything changed.

The brothers had decided to develop a game that adults would enjoy and created a world filled with puzzles. Clearly an influence to later 'sandbox games', Myst takes place on an island that the player has to explore. There is little instruction given to the player who is given more freedom than had been seen in a game at that time.

The lush graphics and realistic sounds were periodically interrupted by video from the evil brothers who vie for the player's assistance. In an interview with Retro Gamer Magazine, Robyn Miller explained that neither of them took the videography seriously. The result was a mess of shaky footage which would be disguised by visual effects.

While being heralded as a remarkable piece of gaming, Myst was still confined to the limitations of early 90s technology. As a result the game does not move in the same way a typical first person shooter would. Instead the position you click is presented to you without any motion. It is reminiscent of earlier golf titles, such as the Leaderboard series.

Myst was a tour de force that started a franchise. The sequel, Riven, was released in 1997 with several more additions being added to the series over time. Even the original game has been rereleased with updated graphics and even with a fully 3D engine. With multiple endings, the game has plenty of staying power for those who enjoy open worlds and plenty of puzzles.

If you were going to release a multimedia space adventure and you really want to show off your sci-fi credentials, then you could do worse than casting Mark Hamill as your title character. Mark plays Blair, a very different character to Luke Skywalker, and a man who must make many difficult decisions regarding space battles and his love interests.

Creator Chris Roberts always felt like the original Wing Commander games were close to being the interactive movie he so desperately wanted to make, and when Wing Commander 3 was released he publicly declared that "this is a movie". Featuring an all star cast, including the aforementioned Hamill, John Rhys-Davis, Malcolm McDowell and Back to the Future's Tom Wilson, it would be difficult to argue with the man.

While the theatrical elements of Wing Commander 3 are regarded as brilliant, the in-game graphics are often ignored. Using polygons, for the first time in the series, to create the ships allowed movement to feel much more realistic. Chris Roberts also introduced Super VGA graphics, allowing high res graphics to take the stage for the gameplay portions of the game. The in-play graphics and design of the ship interior are all designed to mirror the aesthetics of the interactive video scenes, providing a singular experience.

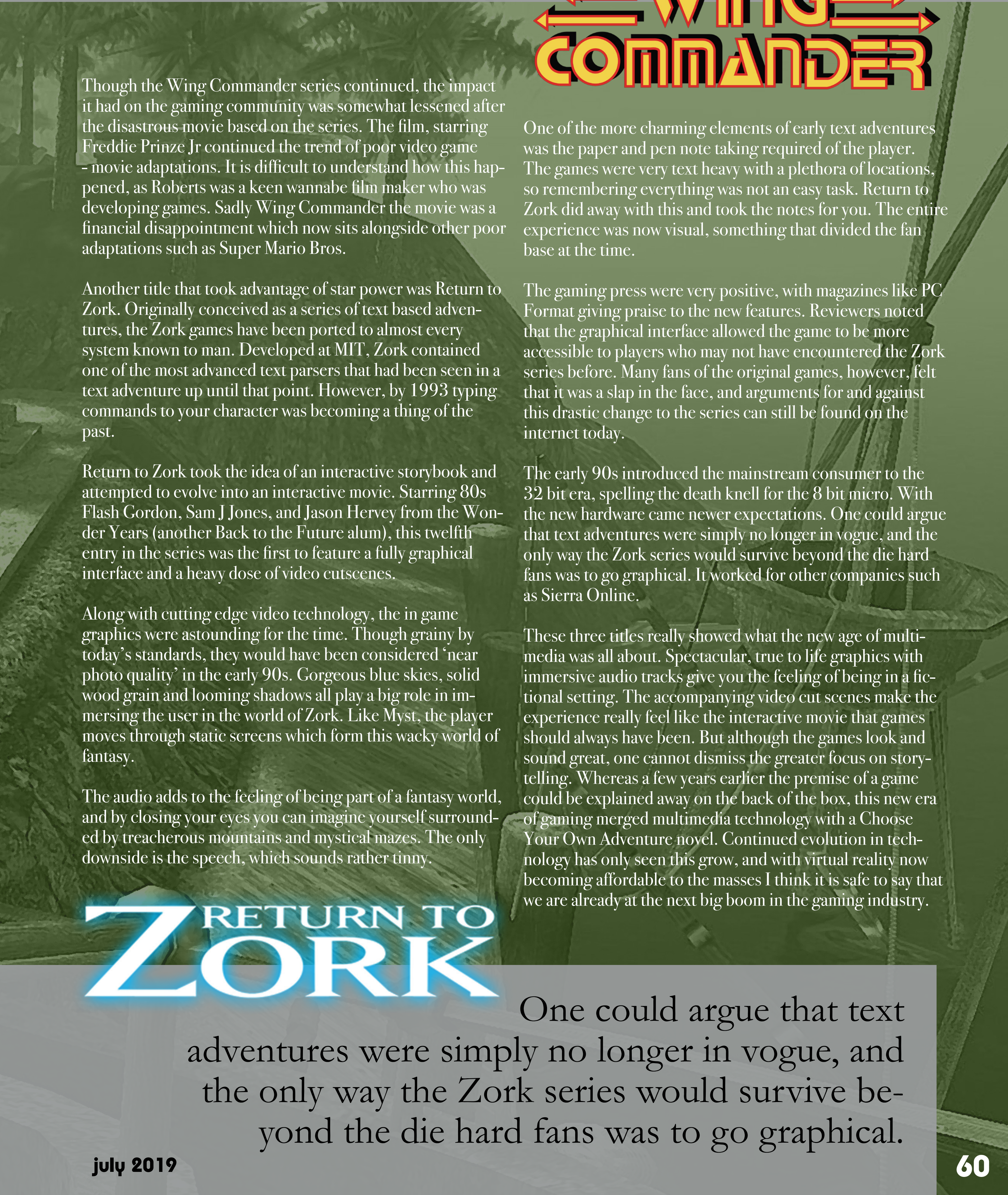
The interactive elements of the game will affect how the flight scenes play out. At the start of each mission you get to choose your wing man, though how they feel about you, as controlled through the interactive movie part of the game, will affect how they react towards you. If you come down on your wing mates and their morale is low then they can make mistakes during missions.

Though this game is considered the finale to the Kilrathi war, a sequel was commissioned featuring most of the cast from the third game, including Mark Hamill. This new story takes place after the war, and reviews at the time noted that more emphasis was placed on the interactive movie parts of the game, destroying the balance that had been such a part of Wing Commander 3.

With multiple endings, Myst has plenty of staying power for those who enjoy open worlds and plenty of puzzles.

If you were going to release a multimedia space adventure and you really want to show off your sci-fi credentials, then you could do worse than casting Mark Hamill as your title character.

WING COMMANDER



Though the Wing Commander series continued, the impact it had on the gaming community was somewhat lessened after the disastrous movie based on the series. The film, starring Freddie Prinze Jr continued the trend of poor video game - movie adaptations. It is difficult to understand how this happened, as Roberts was a keen wannabe film maker who was developing games. Sadly Wing Commander the movie was a financial disappointment which now sits alongside other poor adaptations such as Super Mario Bros.

Another title that took advantage of star power was Return to Zork. Originally conceived as a series of text based adventures, the Zork games have been ported to almost every system known to man. Developed at MIT, Zork contained one of the most advanced text parsers that had been seen in a text adventure up until that point. However, by 1993 typing commands to your character was becoming a thing of the past.

Return to Zork took the idea of an interactive storybook and attempted to evolve into an interactive movie. Starring 80s Flash Gordon, Sam J Jones, and Jason Hervey from the Wonder Years (another Back to the Future alum), this twelfth entry in the series was the first to feature a fully graphical interface and a heavy dose of video cutscenes.

Along with cutting edge video technology, the in game graphics were astounding for the time. Though grainy by today's standards, they would have been considered 'near photo quality' in the early 90s. Gorgeous blue skies, solid wood grain and looming shadows all play a big role in immersing the user in the world of Zork. Like Myst, the player moves through static screens which form this wacky world of fantasy.

The audio adds to the feeling of being part of a fantasy world, and by closing your eyes you can imagine yourself surrounded by treacherous mountains and mystical mazes. The only downside is the speech, which sounds rather tinny.

One of the more charming elements of early text adventures was the paper and pen note taking required of the player. The games were very text heavy with a plethora of locations, so remembering everything was not an easy task. Return to Zork did away with this and took the notes for you. The entire experience was now visual, something that divided the fan base at the time.

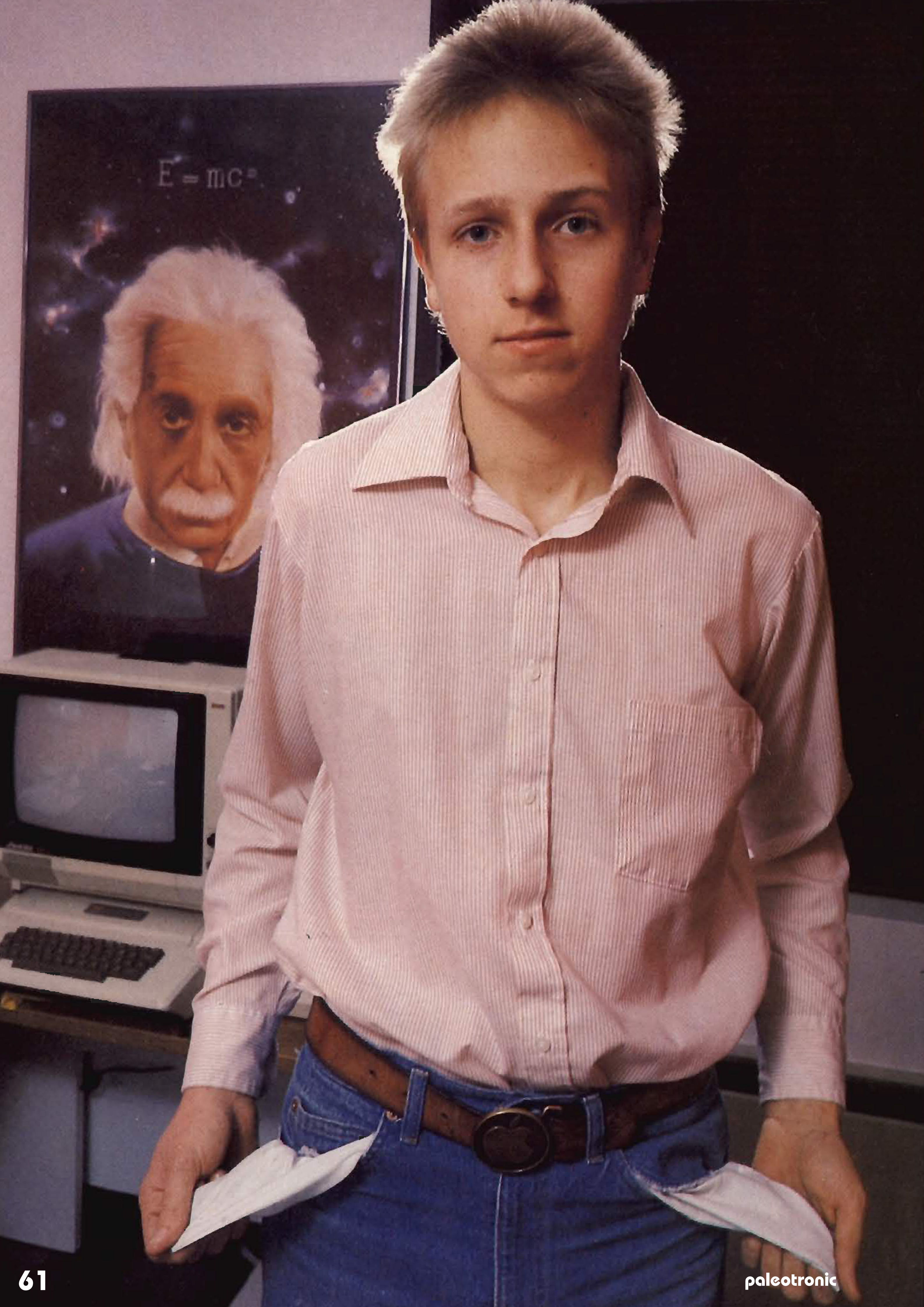
The gaming press were very positive, with magazines like PC Format giving praise to the new features. Reviewers noted that the graphical interface allowed the game to be more accessible to players who may not have encountered the Zork series before. Many fans of the original games, however, felt that it was a slap in the face, and arguments for and against this drastic change to the series can still be found on the internet today.

The early 90s introduced the mainstream consumer to the 32 bit era, spelling the death knell for the 8 bit micro. With the new hardware came newer expectations. One could argue that text adventures were simply no longer in vogue, and the only way the Zork series would survive beyond the die hard fans was to go graphical. It worked for other companies such as Sierra Online.

These three titles really showed what the new age of multimedia was all about. Spectacular, true to life graphics with immersive audio tracks give you the feeling of being in a fictional setting. The accompanying video cut scenes make the experience really feel like the interactive movie that games should always have been. But although the games look and sound great, one cannot dismiss the greater focus on storytelling. Whereas a few years earlier the premise of a game could be explained away on the back of the box, this new era of gaming merged multimedia technology with a Choose Your Own Adventure novel. Continued evolution in technology has only seen this grow, and with virtual reality now becoming affordable to the masses I think it is safe to say that we are already at the next big boom in the gaming industry.

RETURN TO ZORK

One could argue that text adventures were simply no longer in vogue, and the only way the Zork series would survive beyond the die hard fans was to go graphical.


E = mc²

ARCADE RATS

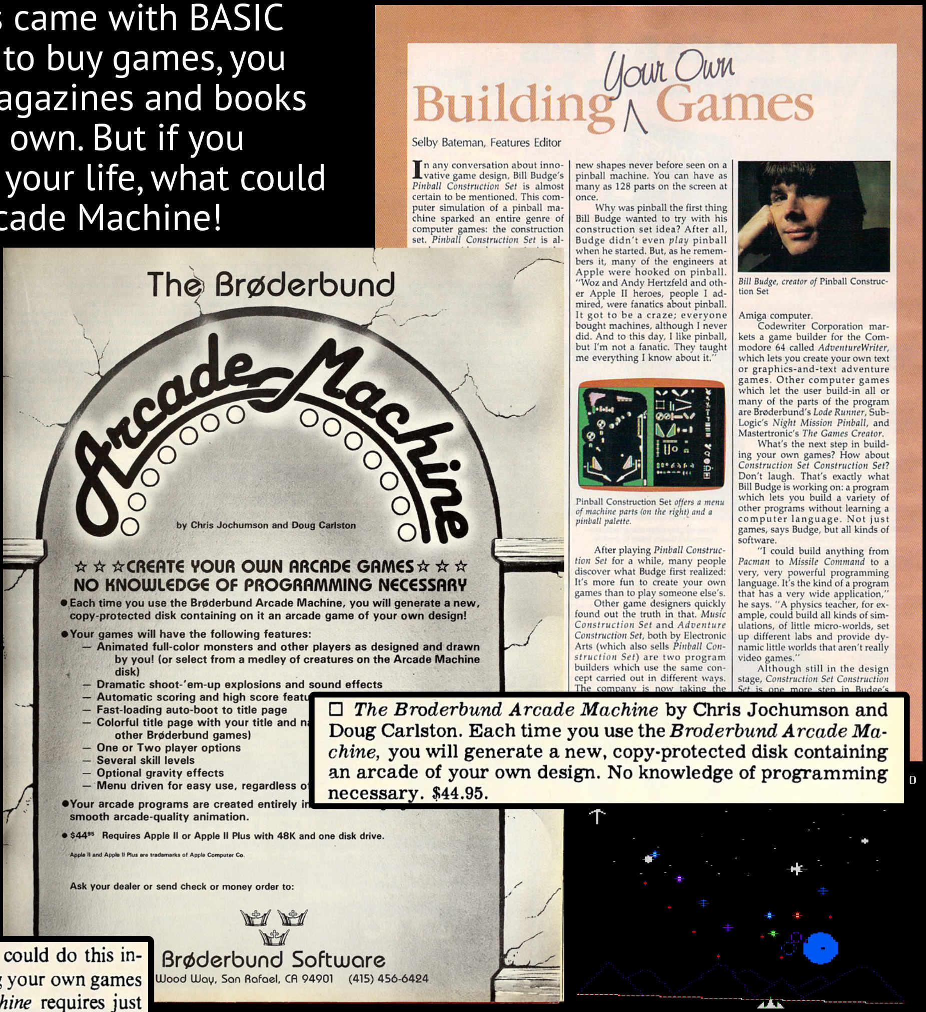
NO MONEY? MAKE YOUR OWN GAMES!

In the 1980s most computers came with BASIC built-in. If you had no money to buy games, you could type in listings from magazines and books from the library or write your own. But if you couldn't code or type to save your life, what could you do? You could get the Arcade Machine!

Broderbund founder Doug Carlston had a vision: what if he created a 'game' that created other games? He teamed up with Chris Jochumson and they came up with The Arcade Machine.

The Arcade Machine allowed the user to create alien-attack style games such as Galaxian. You could design and animate enemies, players and explosions, create movement and firing patterns for enemies, draw backgrounds and title screens, and create sound effects.

True, the Arcade Machine wasn't free. But you could create a fairly wide variety (albeit within a specific genre) of games without having to shell out a lot of money.



Building Your Own Games

Selby Bateman, Features Editor

In any conversation about innovative game design, Bill Budge's *Pinball Construction Set* is almost certain to be mentioned. This computer simulation of a pinball machine sparked an entire genre of computer games: the construction set. *Pinball Construction Set* is al-

new shapes never before seen on a pinball machine. You can have as many as 128 parts on the screen at once.

Why was pinball the first thing Bill Budge wanted to try with his construction set idea? After all, Budge didn't even *play* pinball when he started. But, as he remembers it, many of the engineers at Apple were hooked on pinball. "Woz and Andy Hertzfeld and other Apple II heroes, people I admired, were fanatics about pinball. It got to be a craze; everyone bought machines, although I never did. And to this day, I like pinball, but I'm not a fanatic. They taught me everything I know about it."

Pinball Construction Set *offers a menu of machine parts (on the right) and a pinball palette.*

After playing *Pinball Construction Set* for a while, many people discover what Budge first realized: It's more fun to create your own games than to play someone else's.

Other game designers quickly found out the truth in that. *Music Construction Set* and *Adventure Construction Set*, both by Electronic Arts (which also sells *Pinball Construction Set*) are two program builders which use the same concept carried out in different ways. The company is now taking the

Bill Budge, creator of Pinball Construction Set

Amiga computer.

Codewriter Corporation markets a game builder for the Commodore 64 called *AdventureWriter*, which lets you create your own text or graphics-and-text adventure games. Other computer games which let the user build-in all or many of the parts of the program are Brøderbund's *Lode Runner*, SubLogic's *Night Mission Pinball*, and Mastertronic's *The Games Creator*.

What's the next step in building your own games? How about *Construction Set Construction Set*? Don't laugh. That's exactly what Bill Budge is working on: a program which lets you build a variety of other programs without learning a computer language. Not just games, says Budge, but all kinds of software.

"I could build anything from *Pacman* to *Missile Command* to a very, very powerful programming language. It's the kind of a program that has a very wide application," he says. "A physics teacher, for example, could build all kinds of simulations, of little micro-worlds, set up different labs and provide dynamic little worlds that aren't really video games."

Although still in the design stage, *Construction Set Construction Set* is one more step in Budge's

The Brøderbund

Arcade Machine

by Chris Jochumson and Doug Carlston

☆ ☆ ☆ CREATE YOUR OWN ARCADE GAMES ☆ ☆ ☆
NO KNOWLEDGE OF PROGRAMMING NECESSARY

- Each time you use the Brøderbund Arcade Machine, you will generate a new, copy-protected disk containing on it an arcade game of your own design!
- Your games will have the following features:
  - Animated full-color monsters and other players as designed and drawn by you! (or select from a medley of creatures on the Arcade Machine disk)
  - Dramatic shoot-'em-up explosions and sound effects
  - Automatic scoring and high score featu
  - Fast-loading auto-boot to title page
  - Colorful title page with your title and na other Brøderbund games)
  - One or Two player options
  - Several skill levels
  - Optional gravity effects
  - Menu driven for easy use, regardless o
- Your arcade programs are created entirely in smooth arcade-quality animation.
- $44.95 Requires Apple II or Apple II Plus with 48K and one disk drive.

Apple II and Apple II Plus are trademarks of Apple Computer Co.

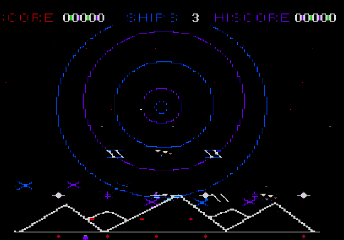
Ask your dealer or send check or money order to:

Brøderbund Software
Wood Way, San Rafael, CA 94901 (415) 456-6424

☐ *The Broderbund Arcade Machine* by Chris Jochumson and Doug Carlston. Each time you use the *Broderbund Arcade Machine*, you will generate a new, copy-protected disk containing an arcade of your own design. No knowledge of programming necessary. $44.95.

> If you've ever been enjoying a game but wished it could do this instead of that, you'll thoroughly enjoy custom-designing your own games to suit your moods and tastes—and the *Arcade Machine* requires just enough of you that you'll feel immense satisfaction and pride in your accomplishment. And therein lies the other side of the coin.

The Arcade Machine cost US$60 – as little as $1 a game if you made 60!



And you might learn a thing or two about how games were created while you were at it!

"Designing video games is an arcane art the secrets of whose craftsmanship reside within the very machine code of the computer itself," declared the New York Times in a 1983 review. But the Arcade Machine could unlock those secrets – sort of.

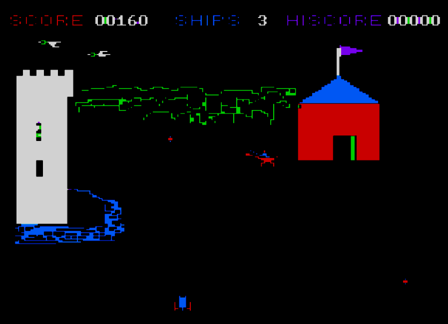
In line with its target genre, the shape editor refers to 'tanks' and 'aliens' – the former representing the player and the latter representing the enemies that must be destroyed.

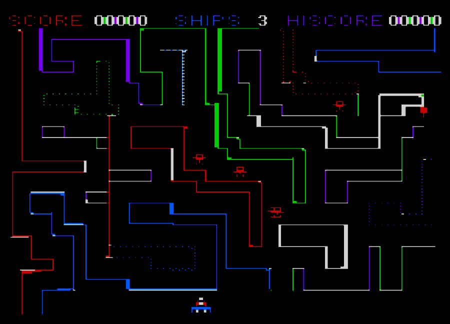
In designing these shapes you can use any of the six colours available in the Apple II's HGR graphics mode: black, white, green, purple, orange and blue. You can also create 'explosions' (the result of shooting an alien), and the 'missiles' fired by the tanks.

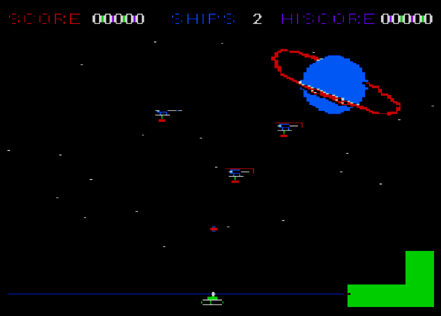
A second editor, called the path creator, lets you create the paths the aliens follow, including the speed at which they follow it, which can be variable. Between the two you can create a simple Space Invaders clone. Job done.

But wait, there's more! You can set the scores achieved for destroying each enemy type and the sound effects that happen when you destroy them. Aliens that are left alone for too long can 'mutate' into other aliens with different paths. There's also a two-player ability.

Hours (days? weeks?) of fun!







PUT US OUT OF BUSINESS! THE ARCADE MACHINE lets you design and produce your own computer games, without any programming knowledge! Send us your best game and enter the BRØDERBUND ARCADE MACHINE CONTEST. We'll be giving away thousands of dollars worth of hardware and software in prizes. If you have a creative touch and an artistic eye, you too can be an arcade designer. Write to Brøderbund for contest details or visit your participating retail store! (Available on Apple disk.)

"Century Concepts acquired low-quality master video games manufactured by General Masters Corp. of Los Angeles that were not designed for commercial use."

ALA ENTERPRISES, INC.

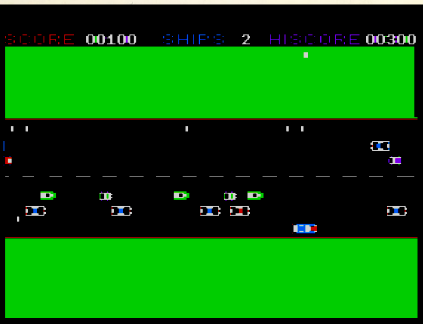
4218 Jefferson Blvd. Los Angeles, CA 90016

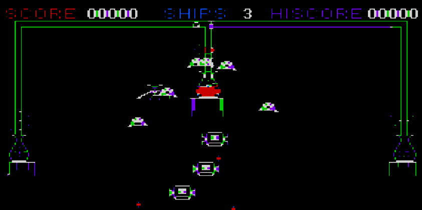
Please include $2.00 postage and handling with each complete order.
ALL ORDERS WILL BE SHIPPED WITHIN 14 DAYS OF RECEIPT OF PAYMENT
TO ORDER—Send Check or Money Order to
ALA ENTERPRISES, INC. 4218 Jefferson Blvd., Los Angeles, CA 90016

"On April 5, 1985, petitioner received the first and only payment from ALA in the amount of $3.59 representing income earned from the sale of copies of (his) video games."

"Mr. Denham found that General Masters primarily developed video games for the purpose of selling them for use in tax shelters."

ALA Enterprises (aka General Masters Corp.) actually sold games made with The Arcade Machine... but they weren't even good by TAM standards! They could be bought for $5 from Kay Bee Toys in the US... and people wanted refunds! The quotes above are from actual court cases involving ALA Enterprises...



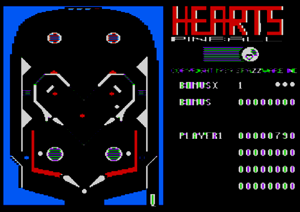


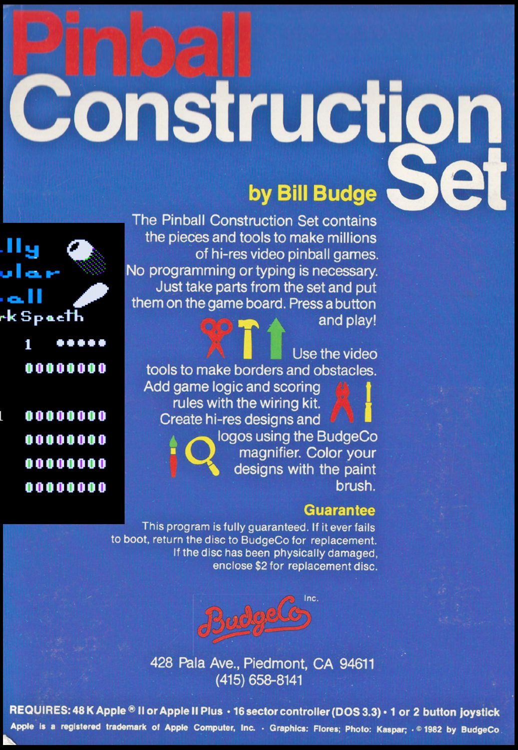
Now, ALA's antics shouldn't reflect poorly on The Arcade Machine... for what it was, it did a fairly good job, and importantly it allowed people to dip their toes in the water in terms of writing their own games. But what if you weren't into shooting games? What if you wanted to create something a little more laid back? Well, have we got the software for you!

Bill Budge's Pinball Construction Set could make, well, pinball games. Published by Electronic Arts, PCS let you drop bumpers, flippers, spinners and other pinball elements on to a playfield, and then customise their behaviour, the behaviour of the ball and of the table in general. This had the potential for lots of variety.

After developing the Raster Blaster pinball game for the Apple II, Budge decided he could turn it into a construction set. It was a very smart idea!

Like The Arcade Machine, finished games could be saved in an executable format on disk and freely traded (allowing for a number of 'public domain' pinball tables to appear on computer bulletin-board systems and eventually the Internet.)





Pinball Construction Set

by Bill Budge

The Pinball Construction Set contains the pieces and tools to make millions of hi-res video pinball games. No programming or typing is necessary. Just take parts from the set and put them on the game board. Press a button and play!

Use the video tools to make borders and obstacles. Add game logic and scoring rules with the wiring kit. Create hi-res designs and logos using the BudgeCo magnifier. Color your designs with the paint brush.

Guarantee

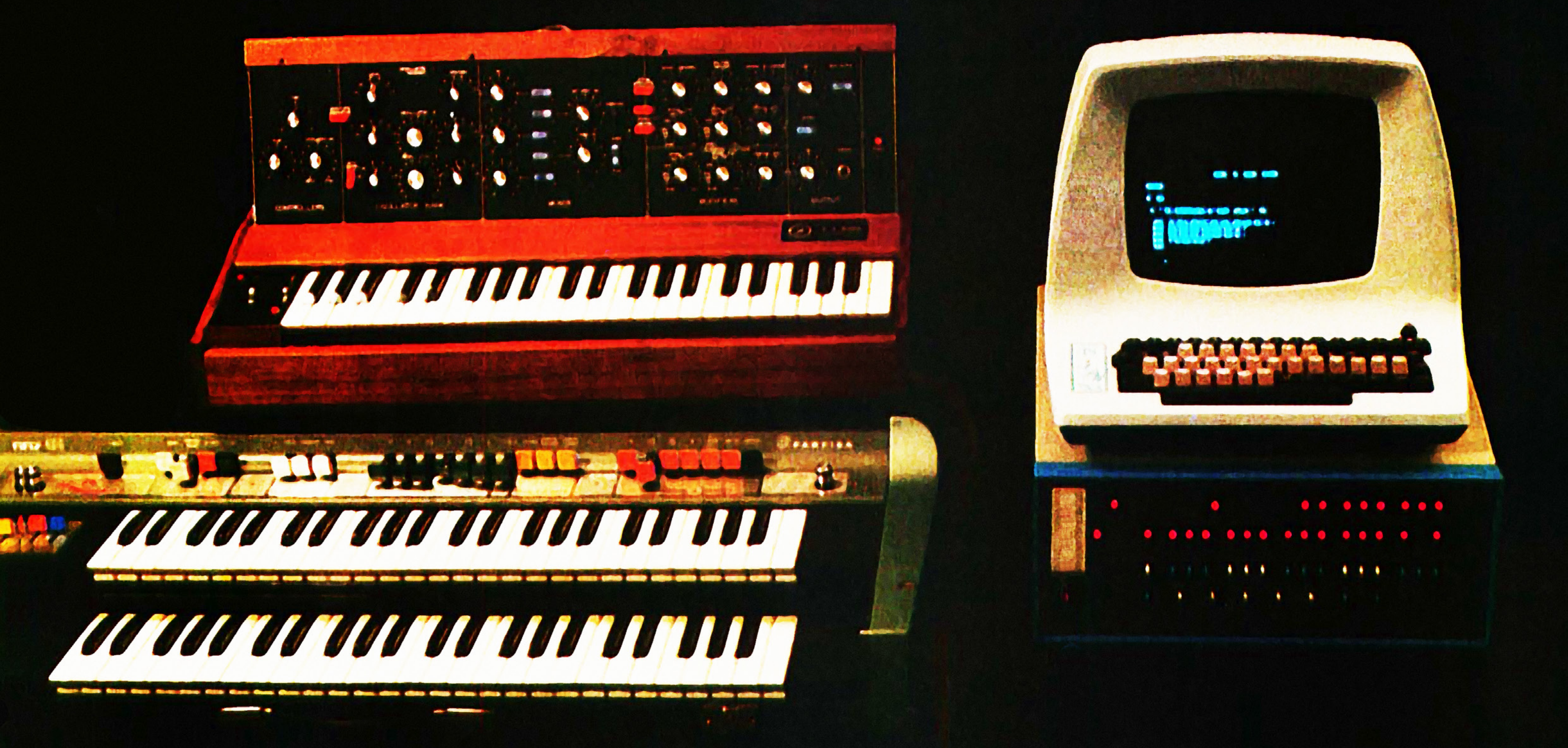
This program is fully guaranteed. If it ever fails to boot, return the disc to BudgeCo for replacement. If the disc has been physically damaged, enclose $2 for replacement disc.

BudgeCo Inc.

428 Pala Ave., Piedmont, CA 94611
(415) 658-8141

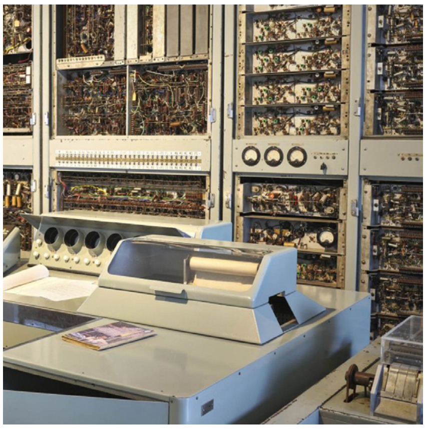
REQUIRES: 48 K Apple® II or Apple II Plus • 16 sector controller (DOS 3.3) • 1 or 2 button joystick

Apple is a registered trademark of Apple Computer, Inc. • Graphics: Flores; Photo: Kaspar; • © 1982 by BudgeCo



From the Laboratory to the Arcade: Computer Music

There are five senses: touch, taste, smell, sight and hearing. Computers have always been tactile – you have to touch them in order to use them (at least until relatively recently.) You can twiddle knobs, push buttons, punch keys, pull joysticks, drag mice... computer engagement through sight has also always been a thing, either through blinking lights or printouts or CRT tubes or LCD and LED panels.



The CSIRAC computer, built in 1949.

The practical applications of a computer creating smells or tastes are somewhat limited (in a personal context; I'm sure there are computers making perfumes and soup seasonings somewhere, but that's not what I'm thinking of) – there's probably no need to smell your database search or taste your rocket trajectory.

But sound... computers were made for it!

Sound is ultimately mathematics. Even noise is not 'noise', per se – it has component parts, each of which is there for a reason, and each of those reasons at its root has a formula of some kind: a hammer hitting a rock causes a specific sound, depending on the density of the rock, the type of metal in the hammer.
A car crash is a symphony of thousands of sounds, each the result of some sort of impact. If you modeled a car and then simulated a crash, you could algorithmically recreate them, mixing them together appropriately depending on the point-of-view of the observer (or victim.)

Given that, music should be a piece of cake!

The first computer to play music was the CSIRAC, Australia's first digital computer, in 1950. Mathematician Geoff Hill used the computer to vibrate a speaker, generating a 1-bit square wave. In 1951 the CSIRAC publicly played the "Colonel Bogey March".

Some early personal computers (the Apple II, the ZX Spectrum, the IBM PC) would use the same process to generate audio, sending electrical pulses to built-in speakers. While you can make simple bleeps and bloops, playing more than one sound or tone at once is complex and the result is generally poor. But the method is simple and cheap, although it relies on the CPU to constantly 'hit' the speaker which has a significant cost in terms of processor usage.
But at least the computer made noise (unlike the Sinclair ZX80/81 or original Commodore PET, for example), so there was that.

Alphanumeric Music

by Melanie Jubb, 188 S 14th St, San Jose CA 95112

Melanie Jubb's oil painting celebrates the idea of computers and music, emphasizing this issues's artistic themes.■

> The first computer sound effects made use of just about any piece of hardware available, producing some rather strange results. For example, innovative computer users wrote programs to make the keys on printers strike in rhythmic patterns. Others altered the sounds from transistor radios by experimenting with the frequency interference created when programs run at high speed in a computer. Even the cassette port on a computer, which is an audio output, has been used to make limited sounds. *COMPUTE!'s Gazette* May 1984

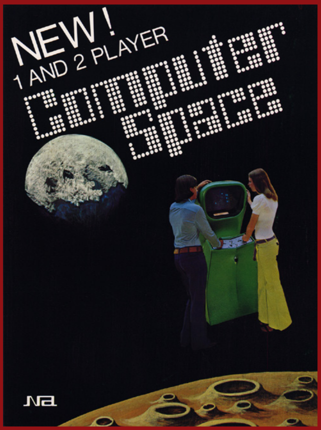

Max Mathews and Joan Miller at Bell Labs (top-left) An IBM 704 system (bottom-right)

Computers would begin to make more sophisticated sounds in 1957, after engineer Max Mathews of Bell Labs wrote MUSIC I on a valve (vacuum-tube)-based IBM 704. MUSIC I was able to generate a simple triangle wave tone with no attack or decay control, only amplitude, frequency and duration – amplitude perhaps being the only advantage over the CSIRAC's 1-bit beeper. (Americans seem to credit MUSIC with generating the first computer music and ignore the CSIRAC but as a Canadian I will have to side with the Australians on this one.)

However, by 1958 MUSIC had made some pretty serious leaps forward: running on the transistor-based IBM 7094-series, MUSIC II had four-voice polyphony and could generate sixteen different sound wave shapes. By the next year Mathews had added 'unit generators' – basically the ability to chain various bits of code (oscillators, filters, envelope shapers etc.) together using a syntax entered on a punch card (much like connecting various pieces of audio equipment together in sequence using patch cables).

MUSIC III could also take a musical score (on another punch card) and together (instruments and music) created a digital song on computer tape (after a while...) MUSIC IV was a rewrite co-written with Joan Miller and completed in 1963, and MUSIC V was rewritten once again in 1967 – this time in the FORTRAN programming language specifically for the IBM 360-series of mainframe computers. MUSIC V could run on any IBM 360 and, as Mathews convinced Bell Labs not to copyright the software (what did they pay him for? Seriously😂) it spread far and wide.

In the 1970s people started hooking computers up to analogue synthesisers. The computers would electronically trigger the keys and control the various oscillators and other controls, but it could do so very rapidly, generating new sounds otherwise literally unheard of. A specialised computer, the Roland MC-8 MicroComposer designed by Canadian Ralph Dyck, was released in 1977 using the then-new Intel 8080 processor (the one used in the Altair). However it cost US$5000 (over US$20,000 today!) and so, few units were sold.



Computer Space had sophisticated sound but was expensive to manufacture.

Six years earlier Nolan Bushnell and Ted Dabney had developed Computer Space, the first arcade video game, which had solid-state circuitry that generated several different sounds simultaneously – impressive considering it was the first. A year later Bushnell's Atari released Pong, which had only simple bleeps and bloops but would be the first time many people would've heard electronically-generated sound directly from the oscillator's output. But neither of these games were particularly musical.

The first videogame music appeared in 1975. The western duel game Gun Fight featured a little death ditty. It wasn't much and it was repetitive but it was music! The US version of Gun Fight was also the first arcade game to use a microprocessor (the 8080, making another appearance). Space Invaders (1978) was the first to have music during play, a four-note descending bass ditty that repeated over and over, increasing in pace as the aliens got closer.

As the sound in videogames improved, those advancements immediately became what was expected by arcade players in successive games. The Atari 2600, released in 1977, marketed itself as a home arcade system, and came with a simple sound chip that allowed for some music, but unfortunately notes were programmed at intervals that substantially differed from those of the usual Western chromatic scale. As a result, melodies sounded strange and alien, and attempts to replicate tunes used in arcade games fell literally flat.

During this same period, home computers were beginning to emerge as a viable industry, their increasing manufacture (and that of arcade machines and consoles) driving the price of microchips down.

Atari would hope to redeem itself for the 2600's terrible sound with its home computer line, released in 1979. Engineer Doug Neubauer designed its POKEY chip. It was capable of four channels of 8-bit tone resolution (or two 16-bit channels) and each channel could either be a square wave or noise. Unfortunately in four-channel mode, with only 256 possible tone values, some 'notes' were still a bit off! In two-channel mode, accuracy was much better. You could also add distortion to make notes sound 'meatier'.

The POKEY wasn't just used in Atari's home computers – they used them in arcade games as well (including Centipede, Missile Command and Gauntlet).

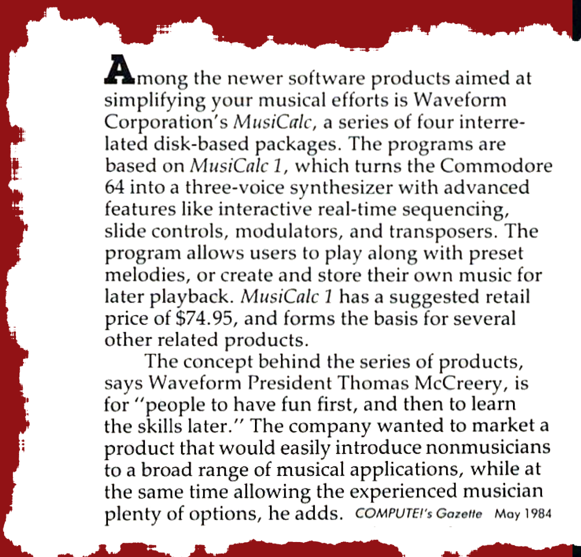
Commodore realised that if it was going to compete with Atari it was going to need sound in its new low-cost computer. Commodore engineer Al Charpentier had designed a combination video and sound chip in 1977 intended to be used in a console competitor for the Atari 2600, but Commodore couldn't find a buyer for the chip and had had no appetite to market their own videogame system, that being considered 'off brand'.

So they used the chip, known as the VIC (Video Interface Chip) as the basis for the VIC-20. The VIC had three pulse-wave generators, each of which had a range of three octaves, and each an octave apart (giving a range of five octaves). It also had a noise generator, but only a single volume control for all of them. But that was enough for buyers of the VIC-20, which sold like hotcakes, becoming the first computer model to sell over a million units.

Across the pond, meanwhile, British company Acorn was developing a computer for broadcaster BBC known as the BBC Micro. It used the Texas Instruments SN76489 chip for sound, which had three square wave generators (with 16-bit frequency precision) at 16 different volume levels, and a noise generator. The chip was also used in Texas Instruments' TI-99/4A, the Colecovision and the IBM PCjr.

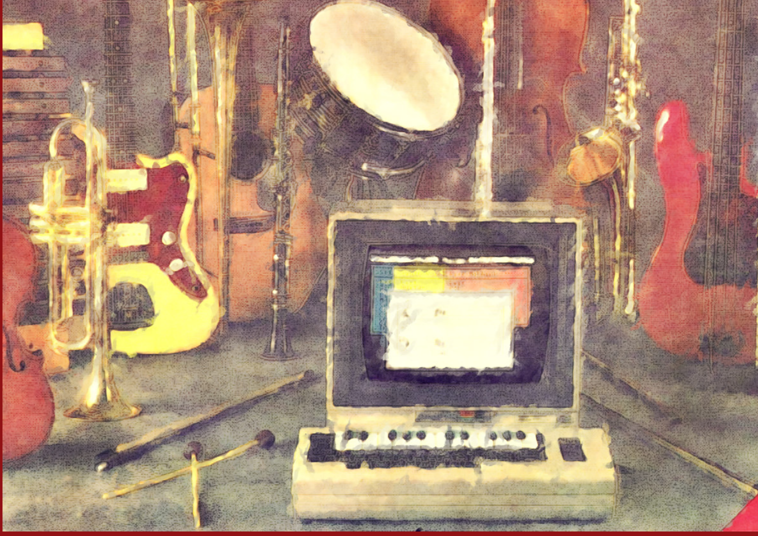
The SN76489 was similar in design to the General Instrument AY=3=8910 chip, which was used in the ZX Spectrum 128, Amstrad CPC, the MSX family, and as part of a popular sound card for the Apple II called the Mockingboard.

While the sound chip inside the computer was unchanging, the software that used it evolved over time, as programmers found various methods of squeezing everything they could out of the chip.



Among the newer software products aimed at simplifying your musical efforts is Waveform Corporation's *MusiCalc*, a series of four interrelated disk-based packages. The programs are based on *MusiCalc 1*, which turns the Commodore 64 into a three-voice synthesizer with advanced features like interactive real-time sequencing, slide controls, modulators, and transposers. The program allows users to play along with preset melodies, or create and store their own music for later playback. *MusiCalc 1* has a suggested retail price of $74.95, and forms the basis for several other related products.

The concept behind the series of products, says Waveform President Thomas McCreery, is for "people to have fun first, and then to learn the skills later." The company wanted to market a product that would easily introduce nonmusicians to a broad range of musical applications, while at the same time allowing the experienced musician plenty of options, he adds. *COMPUTE!'s Gazette* May 1984



Yamaha licensed the chip design and manufactured a variant of it known as the YM2149F. The variant was used in the 1985 Atari ST, whose beefier 16-bit processor could drive it quickly enough that four-channel digital sound was possible through it, although at nowhere near the quality of the Paula chip present in the Commodore Amiga, which featured four 8-bit PCM audio channels.

The Atari ST was always the poorer cousin of the Amiga in terms of digital sound, but made up for it somewhat in that, unlike the Amiga, it could still play 8-bit waveform-based music, which by that point had become quite sophisticated, composers using varied techniques to create a veritable orchestra of different instrument timbres.

Videogames arguably sounded 'better' on the Atari ST, despite the Amiga's superior hardware. And for 'quality' music, the ST had built-in MIDI ports, which allowed for the connection of external sound generators and samplers such as the Roland Sound Canvas.

But we can't finish a discussion of early computer music without talking about the king of sound chips, the Sound Interface Device, or SID. But for that you'll have to read the next article.

CHIP TO BE SQUARE

Thanks to a microelectronic marvel called SID (Sound Interface Device), the Commodore 64 has the most advanced music and sound creation system available on any home computer. Packed into one tiny computer chip is nothing less than a sophisticated, programmable, three-voice synthesizer. *COMPUTE!'s Gazette* May 1984

The pinnacle of the 8-bit music era was the SID chip. The MOS Technology 6581 Sound Interface Device was developed by engineer Bob Yannes. VIC chip designer Al Charpentier had recruited Yannes due to his knowledge of music synthesis – Bob was an electronic music hobbyist and had been infatuated with it since the early 1970s.

When the chipset for the Commodore 64 was being designed, he took on the task of designing its sound hardware. "I thought the sound chips on the market, including those in the Atari computers, were primitive and obviously had been designed by people who knew nothing about music." Yannes was determined to design a high-quality instrument chip, with features common to contemporary synthesisers.

Although he only had five months to design it, the finished product was, according to colleague Charles Winterble, "10 times better than anything out there and 20 times better than it needs to be."

Rather than working to a pre-determined set of specifications, the SID team developed the chip organically, adding features as they were practicable. Yannes had a wish-list, and his team managed to implement three-quarters of it before they ran out of time – which was quite the achievement given that the list of features was impressive for the time:

- Three oscillators each with an 8 octave range (16-4000 Hz)
- Four different waveforms (sawtooth, triangle, pulse and noise – other chips usually only used one waveform and had a single noise channel)
- A filter that could operate in low-pass (remove high frequencies), band-pass (remove high and low) and high-pass (remove low) modes.
- Three ASDR (Attack, Sustain, Delay, Release) envelope generators, which allowed for customised volume shaping.

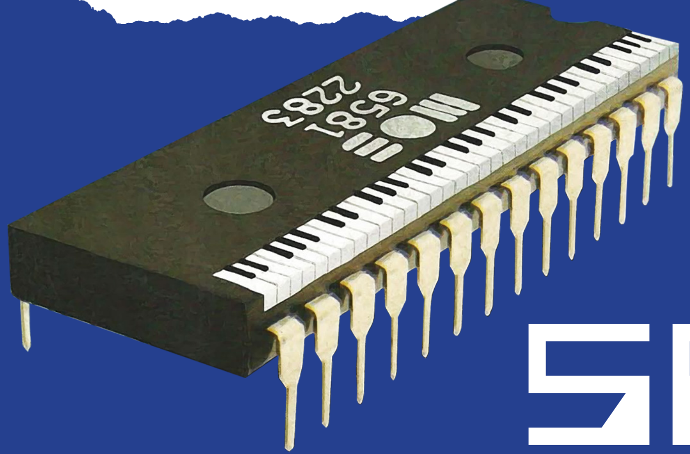
"The SID chip is basically a synthesizer on a chip," says its designer, Bob Yannes. "I played with synthesizers for years, so I'm quite familiar with them. I tried to put it all on a chip with the SID chip."

Yannes designed SID while an engineer for MOS Technology, which is owned by Commodore. He recently left Commodore to form his own company, Peripheral Visions, Inc. Although he won't say for sure what new products his company will introduce, it seems likely that computerized sound devices will be among them. He says chips such as SID are the key.

"There's no reason we can't take music systems being sold now for $4000 and bring them out for consumers for around $400 or $500 – a ten to one cost reduction. I consider the [Commodore] 64 to be only the first step. In the future I'd like to see something totally digital. I think that's the way to go.... I pretty much got the features that I wanted out of the SID chip in the 64, but not the performance I wanted. But now that I've done it once, I think I have a better idea about how to go about it next time."

Yannes says he was given specifications by Commodore only to develop a "sound chip," and then he decided to make it as much like a synthesizer as possible. But he had to work within the limitations of marketing considerations. For example, although SID allows each voice's envelope to be individually programmed, all three voices share the same volume control.

"I had to put separate envelope controls for each oscillator [voice] into the SID chip in order to satisfy the video game/sound effects marketing demands. If I had my way, the three oscillators would work in unison to create one voice. Anyway, that's why there're separate envelope controls for each oscillator but only one peak amplitude [volume] control – it was designed to function as one voice. You could vary the attack of the different oscillators, for example, to get a brassy sort of sound that way."



- Three 'ring modulators' capable of multiplying two waveforms together, creating a distinctive third.
- Two analog-to-digital converters used for paddles or mice.

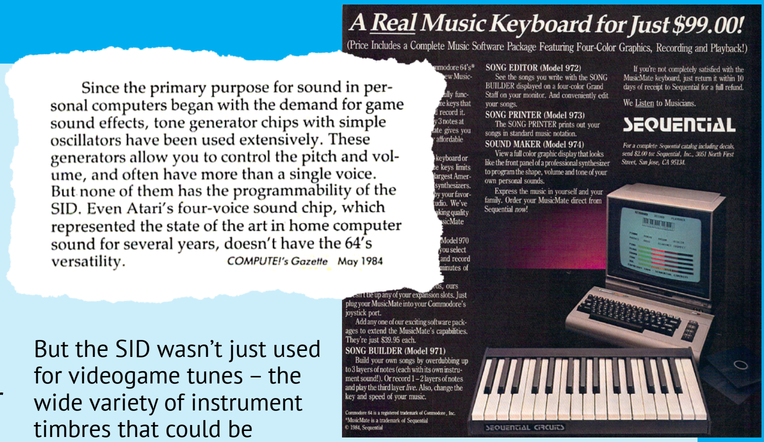
All of these features allowed for the construction of extremely sophisticated timbres at a wide range of frequencies, and resulting in music that was unlike anything anyone had heard out of a home computer (or videogame console) before.

After all, comparing the SID to contemporary sound chips such as the AY-3-8910 was like comparing the Mona Lisa to a puddle of paint on a sidewalk – sure, paint is involved in both of them but there's an obvious discrepancy in terms of sophistication and quality.

Videogame music composers embraced the SID with relish, quickly discovering undocumented 'features' such as the ability to modulate an unintended 'click' that occurred when the volume register was altered in order to play back 4-bit (16 level) digital audio samples – this technique was used in games such as Ghostbusters and Impossible Mission to reproduce speech, and in Arkanoid to replicate musical instruments.

It wasn't long before the SID was recognised as the gold-standard of 8-bit (and 16-bit for that matter) computing sound hardware, and this helped to propel sales of the Commodore 64, which eventually became the most popular home computer model of all time.

As for Yannes? He went on to found Ensoniq along with Charpentier and several other former MOS Technology engineers. Ensoniq designed a number of keyboard synthesisers such as the Mirage DSK-1 and the ESQ-1, which were valued for their 'warm' sound. Ensoniq designed the sound chip used in the Apple IIGS, and also designed a number of computer sound cards, including the Ensoniq Soundscape.



Since the primary purpose for sound in personal computers began with the demand for game sound effects, tone generator chips with simple oscillators have been used extensively. These generators allow you to control the pitch and volume, and often have more than a single voice. But none of them has the programmability of the SID. Even Atari's four-voice sound chip, which represented the state of the art in home computer sound for several years, doesn't have the 64's versatility.

COMPUTE!'s Gazette May 1984

But the SID wasn't just used for videogame tunes – the wide variety of instrument timbres that could be produced by it also made it attractive to those seeking to write music for its own sake, in a wide variety of genres from jazz to classical to rock-and-roll.

To be friendlier for traditional music composers, many of these applications used musical notation to enter tones, for example Will Harvey's Music Construction Set. These programs usually offered a fixed set of instruments that could be chosen from.

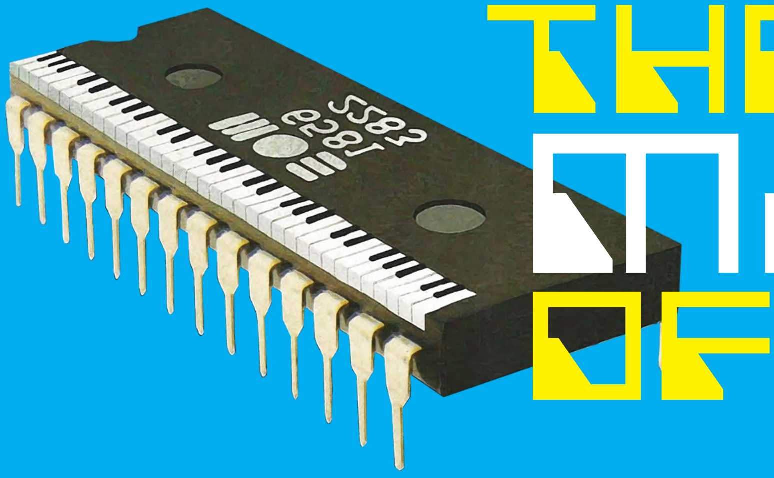
After the introduction of SoundTracker on the Amiga, which processed notes using a 'piano roll' paradigm, similar "trackers" began to appear for the Commodore 64, including Cybertracker. Trackers bridged the gap between traditional notation and complex direct configuration of the SID chip's registers, allowing for both more rapid and straightforward entry of music. Trackers gave users the power to create sophisticated instruments without needing to know the intricacies of the SID and the 64 to do it.

So, what if you want to create music with the SID today? Modern music programs include SID-Wizard, a music tracker, and MSSIAH, a cartridge that contains a MIDI port and a number of software packages including a sequencer and a drum machine.

There's also the Cynthcart, which turns the C64 into a synthesiser you can play live, using a MIDI keyboard (or the C64 keyboard, if you're really desperate!)

Bob Yannes, the designer of the SID chip, says there are a couple of reasons why we haven't seen the SID duplicated or surpassed in other personal computers. "No one has really taken the approach of doing the music synthesizer in a computer the way music synthesizers are really done. Most of the people who work with LSI [Large-Scale Integration of computer circuits] don't have that much experience with synthesizers. They don't know what features are important. They don't know what you do with the things that you put in there."

COMPUTE!'s Gazette May 1984



THE MAGIC OF SID

Geek Underground

> “I STARTED COMPOSING MUSIC WHEN I WAS 12. I WROTE A BASIC MUSIC DRIVER THAT WAS WAY TOO SLOW. MY FRIENDS LIKED THE MUSIC ANYWAY. I DID NOT HAVE ENOUGH EXPERIENCE TO WRITE A MACHINE-CODED MUSIC DRIVER THEN, SO I DECIDED TO USE SOUNDMONITOR. I JOINED A COMPUTER GROUP AND WROTE THE MUSIC FOR A LOT OF THE DEMOS WE DID.

In an interview with Commodore Format published in November of 1994, well-known SID composer Jeroen Tel talked a bit about his career in music to that point…

“When I was 14 I met Charles Deenen (then with Scoop Designs) with whom I founded Maniacs of Noise. Charles programmed the Maniacs of Noise routine and built in all the effects I needed. I composed around 10 tunes for the PCW show (now the ECTS) in London. Companies must have liked them because the orders came in instantly. From that moment things really took off. I worked for a lot of companies as a freelancer. Most arcade game licenses were done through the English development team Probe Software. I always had the freedom to change the original music.

“At 18 I moved to England to work for Probe full time which was a good experience because I got to work with a lot of great guys like Mark Kelley, Steve Crow and Simon Nicol. After working there for six months I moved back to the Netherlands to work as a freelancer again. I founded the company which is the Maniacs of Noise we know today. At the moment I cam doing the music for a lot of different media – television programs, commercials and video games (including CD). I also write songs and occasionally release CDs of my own work.

“I am also working on a library-music CD called Human Emotions. Library music is written especially for TV programs, commercials, films and other audio-visual products. These projects take up a lot of my time. In the remaining time I compose and write songs for myself and personal experiences. Eventually a lot of these songs will be released on an album. My song writing diversifies into a lot of different styles - pop, rock, soul, funk, house, rap, classical etc. Too much to mention, really. You will just have to listen to understand what I mean.”

Born in 1972, Jeroen Tel is a Dutch composer best known for creating music for numerous Commodore 64 games in the 1980s and early 1990s. His most popular compositions appear in games such as Combat Crazy, Cybernoid, Cybernoid II, Dan Dare 3, Eliminator, Hawkeye, Myth, Nighthunter, Robocop 3, Rubicon, Supremacy and others.

In 1987, he founded company and music group Maniacs of Noise, along with Charles Deenen. Since then he has produced the soundtrack for a number of PC, console and mobile games including California Games II for the Sega Master System in 1993, Beauty and the Beast for the NES in 1984, Alien Scum in 2002 and The A-Team in 2010.

Recently he has been working on an album of remixes of some of his best C64 music.

You can listen to some of Jeroen’s large catalog of work at soundcloud.com/maniacs-of-noise

JEROEN TEL

With the introduction of the SID chip, the ability to compose complex electronic music was placed into the hands of many for the first time, including kids, whose parents bought them a Commodore 64 for doing homework, learning to code and playing games – which was all it was for some. But others, such as Jeroen, soon realised the creative potential of the SID, writing software that generated increasingly more sophisticated music.

While those such as Jeroen then found commercial success creating background music for videogames, others simply did it as a hobby, creating music for technical 'demos' that found new ways to exploit the Commodore's graphics and sound hardware, or as standalone 'releases'. The invention of the 'tracker' led to standardised music formats, and the availability of players on multiple computer platforms, meaning that music could be written on one computer and played back on another, and creating a wider audience for music files distributed using bulletin-board systems (BBSes).

As time wore on home computers advanced, and the music software available for them advanced as well. Trackers appeared that supported 16, 32 or even more channels of digital sound, allowing for the creation of sophisticated music indistinguishable from that produced by expensive MIDI hardware at almost no cost.

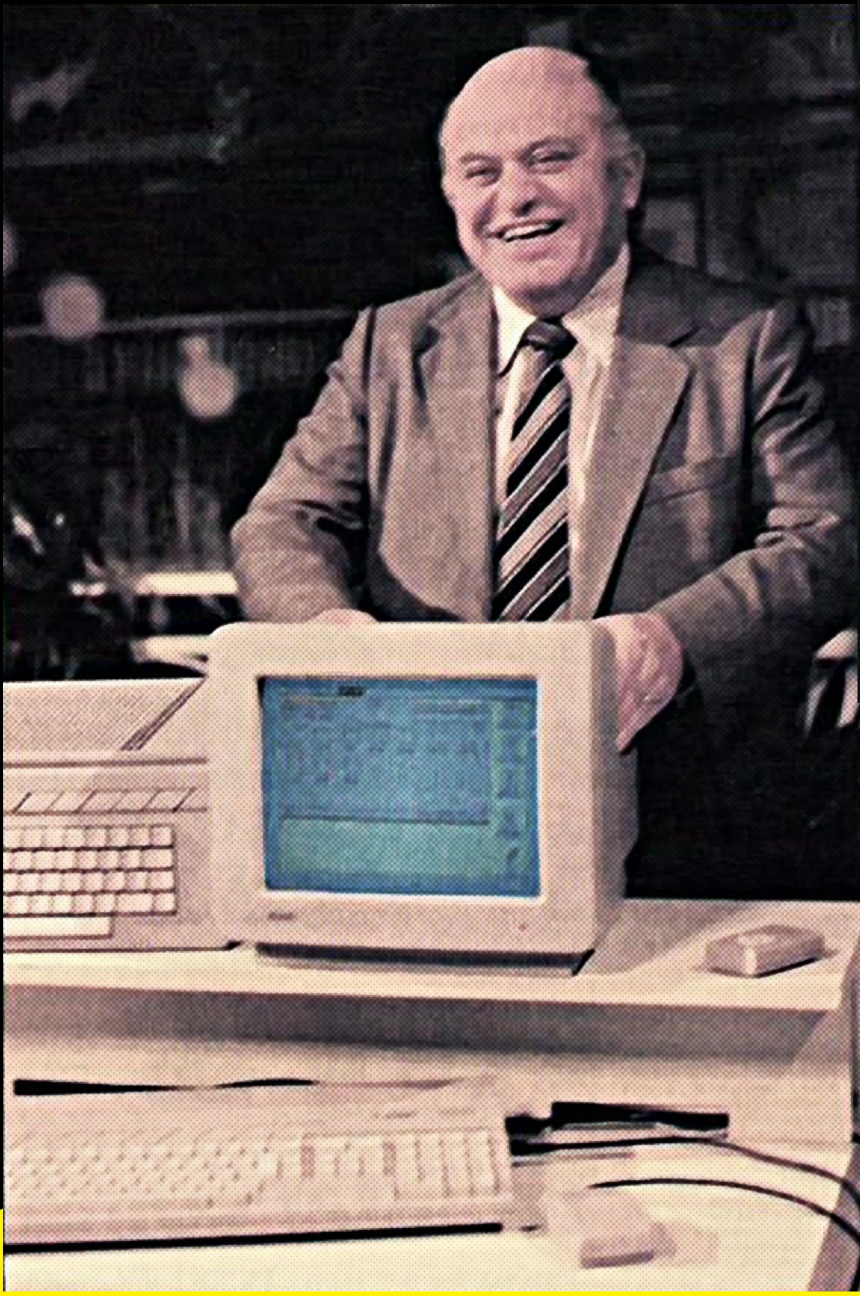
In the last decade professional music software such as Logic Pro has become reasonably affordable (and widely pirated), enabling young people to use the same tools as those creating music commercially. Many of these amateurs have written hits and gone on to substantive music careers. But it was arguably figures such as SID designer Bob Yannes, Jeroen Tel and many others who first broke ground on the trail followed by these 'bedroom musicians' who made this brave new world of free musical expression possible.

The team behind the Commodore 64 version of Lemmings, including Tel, Thomas Mittelmeyer (bottom left), Charles Deenen (centre) and original Lemmings designer Mike Dailly (top right).

Many of those involved in 1980s game development started off as amateurs creating public domain software or 'demo' programs that showed off their skills at coding, graphics or music. Some began to create and sell commercial software on their own, or through distributors.

Then software companies began to hire programmers they had previously bought games from or distributed games for, rather than having to perpetually pay them royalties. This eventually became the status quo. But for a while at least, you could become a millionaire from your bedroom, if you wrote a hit game!

The Rise of the Bedroom Musician



New from Xanth F/X! The game that lets up to 16 people play at the same time on 16 different STs. All networked together using MIDI.

Design your own mazes using First Word™.
Select up to 15 happy face opponents in single player mode.
Requires 1 MIDI cable for each computer in network.

Only $39.95 suggested retail.

For a free product catalog and newsletter call or write us at:

Hybrid Arts, Inc.™

11920 W. Olympic Blvd., Los Angeles, CA. 90064
Computer BBS: (213) 826-4288 **Main Office**: (213) 826-3777 **Telex**: 4931231 (HYBRDUI)

Hybrid Arts offers a full range of MIDI products for the Atari ST including:
EZ-Track™: A 20 track polyphonic MIDI recorder.
EZ-Score™: A sheet music printing program.
CZ-Android™: A patch librarian-editing system for the Casio CZ keyboard series.
DX-Android™: A patch librarian-editing system for the Yamaha DX-7 and TX series.
GenPatch ST™: A generic patch librarian system for all MIDI devices.
MIDITrack ST™: A professional MIDI recorder availlable with and without SMPTE sync.
ADAP SoundRack™: A 16 bit digital audio workstation for music and broadcast pro

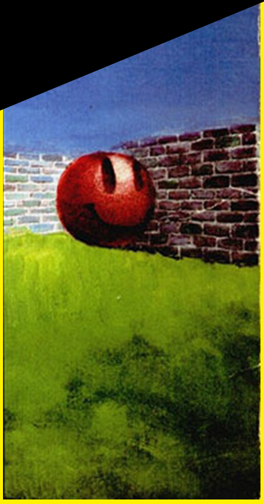
Atari ST is a trademark of Atari Corp.; DX-7 is a trademark of Yamaha International Inc.; CZ and Casio are trademarks of Casio In ST, MIDITrack ST, ADAP SoundRack and Hybrid Arts are trademarks of Hybrid Arts Inc.; DX-Android and CZ-Android are tradem way with LUCASFILM LTD.

POINT AND CLICK: MIDI MAYHEM

In the previous two issues of Paleotronic I have written about RPG games, their origins, the games credited with being the first of their kinds on home computers in the RPG video gaming category. Midi Maze on the Atari ST is another one of these 'very first' of their kind type of video games that I have the pleasure of researching, learning more about and sharing with the retro gaming community. Before we delve into the game MIDI Maze, let's take a very brief look at this MIDI business.

So what's a MIDI ? As I had came to know of it from all the articles I was reading and all the adverts I would see in magazines for such equipment back in the day, I knew it simply as music or more specific as a computer being able to play and create music with equipment such as a keyboard / synthesizer. That was my general knowledge on the subject. It looked and sounded great every time I came across an article about it in a magazine, but I still didn't fully understand it. I mean I would be at my local video game store and there was no one selling anything else but games and computers to play them on. I don't recall seeing any shops promoting they had a MIDI for sale.

Wikipedia explains MIDI as "a technical standard that describes a communications protocol, digital interface, and electrical connectors that connect a wide variety of electronic musical instruments, computers, and related audio devices". I take one read of that and I am like a 16 year old skipping math class so I can go have some fun playing arcade games with my friends.



What it basically means is that MIDI is a means of getting different electrical / computer equipment together and allowing them to communicate with each other. With the proper software, connections and music related hardware i.e. keyboards / synthesizers, what MIDI did and still does is turn your computer into a music making machine. MIDI data can be transferred via a MIDI cable to be recorded to a sequencer for editing and or played back. Before MIDI came along, circa 1983, computers and electronic musical equipment from various manufacturers would struggle to communicate effectively with each other. After 1983 that all changed. With a MIDI compatible computer any other MIDI based electronic equipment could communicate with each other regardless of who the manufacturer was. MIDI also made a universal data file format allowing file sizes to be compacted and allow ease of modification and transfer between computers.

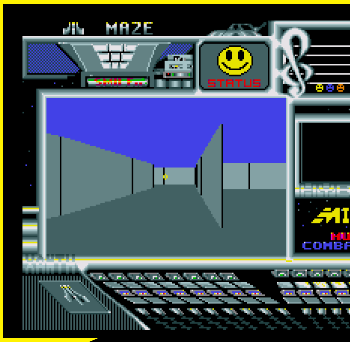
That's the musical reference of MIDI. Yeah I know, lots to take in, if you are like me, you're not that much into creating music on your computer and all you want to do is play games. Which begs the question, just how did this have anything to do with one of the very first multiplayer, networked, first person shooter (FPS) games, called MIDI Maze, on the Atari ST? When you look back, it seems rather odd that this could even happen.

Before Midi Maze had been released on the Atari ST in 1987, network gaming was not common or even widely thought of in home computer gaming. We're talking the biggest names in home computer gaming around this time on 8-Bit / 16-Bit machines were the likes of Dizzy (Codemasters), Head Over Heels (Ocean Software), Airborne Ranger (Microprose Software), Wizball (Ocean Software), Double Dragon (Virgin / Mastertronic) and Barbarian (Palace Software). All these other mentioned games are standard one or two player gaming experiences with a single home computer, MIDI Maze being a networked game is clearly the odd one out.

It is strange but also quite perplexing a networked game had even been released during this era, multiplayer games on home computers let alone networked games had no viable market. Big Software players seemed uninterested in taking a look at networked games, why would they bother, they were making huge profits from traditional based gaming. A glimpse of multiplayer network gaming appeared In 1986 with Flight Simulator II being released (by Sublogic) for the Atari ST and Commodore Amiga. It allowed two or more players to connect via a modem or with a Sublogic serial cable.

From my own memory and experiences at the time, connecting multiple computers to play games against other people seemed like a fantasy, something like the self talking computer in the 1984 movie Electric Dreams. Modems and bulletin boards were still being explored and developed, more likely in the United States, not so much everywhere else. This wasn't a time in home computer gaming when thought and efforts were focused on multiple machine game playing. Networked gaming would be something you would find only at universities, other

than a big multinational corporation, it was the only place feasible to connect multiple machines together. For the average Joe buying one computer was fairly expensive buying more than one computer for the home just wasn't economical or practical. When you think about home computer gaming back then, people were only just starting to buy a second CRT TV for the home so that their children could play on the family computer without causing major headaches for other family members who wanted to watch their favourite tv shows the likes of Benny Hill, The Bill and Eastenders.

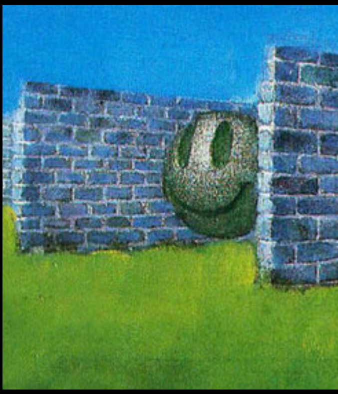


Being a networked game, Midi Maze came out of 'left field', firstly because it was not the normal gaming experience and secondly because it was released by a relatively unknown software company - Xanth Software F/X and released through Hybrid Arts. I use the term 'left field' because MIDI Maze on the Atari ST just wasn't normal gaming, more like a radical experiment and Xanth Software F/X had no prior qualifications in this area, they were better known for their earlier release called the Shiny Bubbles graphic demo, it just didn't compute or make any logic. No one else had even ventured to use a computer's MIDI function ports in this way. Everything I had read about, everything I had come to know about MIDI meant music, so how could MIDI mean multiplayer gaming?

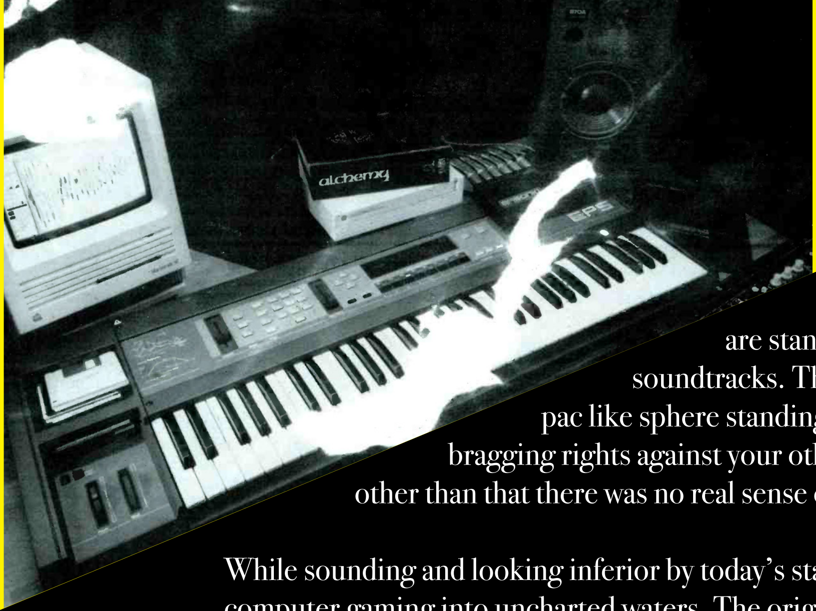
The crazy thing is, a ring of networked computers was made simply by using the Midi-in and Midi-out connectors of the Atari ST. It was that easy and yet it hadn't been done before. Computer 1 Midi-out is connected to Computer 2 Midi-in, Computer 2 Midi-out is connected to Computer 3 Midi-in and so on, the last computer is connected back to Computer 1. This allowed a maximum of 16 Atari ST computers to be connected at the one time to play the same game and so the first of its kind example of a networked multiplayer FPS home computer game was born.

If the network play had been out of 'left field' then so had the game itself. When you think of FPS you think of death, destruction, mayhem, blood, bullets flying off in all directions, well it didn't start that way with MIDI Maze. Instead the player is a Pac-Man like orb in a right angled maze, able to move in any direction and shoot deadly bubbles at other coloured Pacs. Yes I wrote right and you read correctly – deadly bubbles. Oh my, I have to laugh. This was the origins of competitive deathmatch gaming - shooting deadly bubbles to take out your enemy. Even more unconventional is that the Pac's are smiling, can you ever imagine playing a FPS like this, I couldn't but this is how it all began.

To play a game of MIDI Maze, one "master" Atari ST sets the game rules such as revive time, regen time and reload time. It can divide players into teams and select a maze. Many mazes come with the game and additional mazes can be created and played using an editor. The game is played either with joystick or a mouse. If you didn't have more than one computer connected via Midi ports to play against, you could also play in a one player mode, which pitted you against up to 15 computer controlled bots using three levels of AI, 'very dumb', 'plain dumb' and 'not so dumb', i.e easy, moderate and hard.



Graphically the game is not what you may think a FPS would look like. There is so much grey used for floors and walls, the only hints of other colours come in the form of the smiley Pacs, the yellow bubbles you fire at them and the blue roof which must represent the sky? The walls are paper thin and without any texture or ambient lighting. The game area occupies only roughly a quarter of the screen and consists of a first person view of a 3D type maze with a crosshair in the middle. What the game does show is that movement around the maze for this particular era of gaming is exceptionally smooth with quite fast frame rates. Maze exploration and movement for avoiding your enemies quickly is probably the best characteristic that came out of the games development. You can shoot at enemies from short or long distances but your aim had to be good as the movement of your enemy was constant, meaning your shots would often miss its intended target. Enemy smileys have a shadow giving perspective to help you out in this



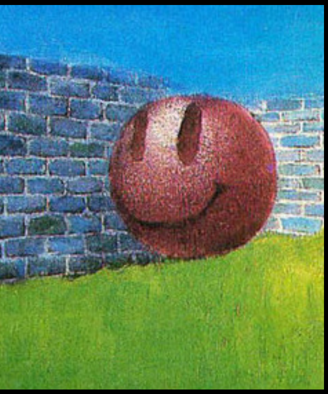
regard but it didn't always materialize in the positive. There is no limits on bullet bubbles, so fire away all you like. The in game sound effects are standard shots being fired, there is no tunes or soundtracks. The whole point of the game is to be the last pac like sphere standing, so its appeal and lastability would be for bragging rights against your other friends hooked up to the network but other than that there was no real sense of achievement.

While sounding and looking inferior by today's standards, MIDI Maze took existing home computer gaming into uncharted waters. The original MIDI Maze team consisted of James Yee as the business manager, Michael Park as the graphic and networking programmer and George Miller writing the AI / drone logic, it was these people that made the very first networked, 3D FPS, home computer game possible, it was the pinnacle of network gaming in 1987, now becoming a video game cult classic on the Atari ST today.

Later in 1990, MIDI Maze II by Markus Fritze, for Sigma-Soft, was released as shareware. Watching the video of MIDI Maze II on Youtube gives a much clearer understanding of how 3D FPS became to be known. While the same game setting is used, in MIDI Maze II the FPS experience is much more enhanced than the original MIDI Maze. Included is a compass, an enemy alert indicator, on screen info such as kills, hits, score and money. The use of sound in the form of nightmarish screams to demonstrate a hit being made, is a realization you are in a competitive deathmatch scenario.

Another variation of the game came with WinMaze, based on MIDI-Maze II supporting up to 32 Windows based players networked via LAN with more improvements. It claimed to be "The best MIDI-Maze II clone ever!". WinMaze was authored by Nils Schneider (with thanks to Jens "Yoki" Unger, who provided socket classes and created the first server version), while Heiko "phoenix" Achilles provided the game's graphics.

In 1991, a Game Boy version was developed by the original developers, Xanth Software F/X, and published by Bulletproof Software (now Blue Planet Software), under the title Faceball 2000. James Yee, owner of Xanth, had a vision to port the 520ST application to the Game Boy. George Miller was hired to re-write the AI-based drone logic, giving each drone a unique personality trait. It is notable for being the only Game Boy game to support 16 simultaneous players. It did so by connecting multiple copies of the Four Player Adapter to one another so that each additional adapter added another two players up to the maximum - seven such adapters were needed for a full 16 player experience.



A SNES version, programmed by Robert Champagne, was released the following year, supporting two players in split screen mode. The SNES version features completely different graphics and levels from the earlier Game Boy version. A variety of in game music for this version was composed by George "The Fat Man" Sanger. A Game Gear version, programmed by Darren Stone, was released to the Japanese market. It is a colourized version of the monochrome Game Boy edition, supporting two players via two handhelds connected by a cable. A version for the PC-Engine CD-ROM, simply titled Faceball, was also available in Japan.

In today's world of plug-and-play peripheral devices, it is difficult to understand the fundamentals of what is happening at the lower levels. How does the computer connect to the device? How does it communicate with the device? How does the software make the device do its magic?

My name is Eric Rangell and I was a teenager in the 1980s. My first computer was an Apple //e in 1983. Before my family got a computer, I learned Basic programming from my brother's college textbook and practiced writing programs on paper for a year before the Apple found a home in my brother's room. With the limited computer time I had, I practiced coding, debugging, and refining my programs until they did what I wanted. The Apple][series of computers was designed so that owners could learn everything about how their machines worked if they took the time to study the available documentation and experiment with the machine. Today, early Apple computers can help young people grasp the fundamentals of how a computer works, and that will help them as they progress in their studies and careers.

In this article I will walk through a simple project that can be built using an Apple][series computer that has an internal Game I/O socket. It uses one of the Annunciator digital outputs to send MIDI data to a MIDI instrument. The process of building it and persisting through any problems you encounter will give you a sense of mastery and enjoyment, give you a tool to express your creativity, and challenge you to continue tinkering with the project as you learn more advanced computer science concepts. Parents and teachers are encouraged to learn how to build this project and help children work through it as they build an electronic device, write simple programs in Basic to control the device, and imagine additional applications that can use the device.

MIDI can play notes and music on keyboard synthesizers, as well as send commands to modules which control music playback, drum patterns, and even lighting. MIDI uses a very simple communication protocol to send binary messages to instruments. There really is nothing magical about it – the computer is just sending bytes which represent commands such as "Play a middle C", "Stop playing the middle C", "Change the instrument sound to Violin", "Change the volume". The objective of this project is for the student to understand how the computer varies voltage levels on an output port using specific timings according to a protocol that the musical instrument receiving the data understands. By building the interface from scratch, the student knows that the data is traveling on wires that they connected, and controlled by software that they wrote, using a driver program that is conceptually easy to understand.

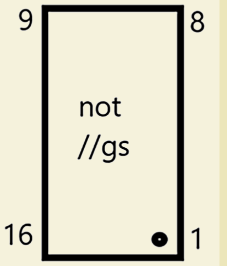
Before you start building the interface, read this entire article and gather the parts you need. Many modern musical instruments have USB interfaces for MIDI. Look for older synthesizer keyboards with the round 5 pin DIN MIDI sockets, or USB MIDI interfaces that have the round connectors. You may need a MIDI coupler in order to connect a MIDI cable to one of those interfaces.

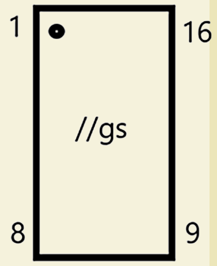
Build a No-Slot MIDI Interface on the apple][Game I/O Socket

the

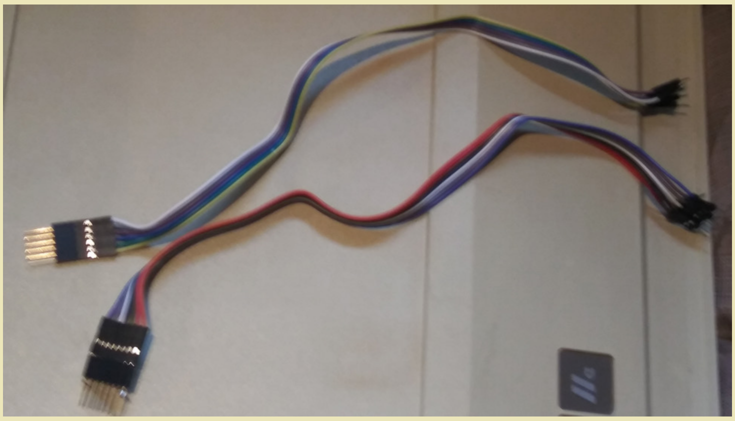
Since this project is going to be built on an Apple][game I/O socket, the first task is to build a cable that makes the socket pins more accessible outside the computer. The best connection is a 16 pin to 16 pin cable where one end plugs into the socket and the other end plugs into a breadboard. If you cannot obtain this cable, you can make your own using ribbon cable with Male to Male pin connectors. If this MIDI interface is the only project you want to build on the Game I/O socket, there are only 3 pins that need to be routed externally. On an Apple //e or //gs, 2 of those pins (+5V and GND) can come from the 9 pin Game connector on the back panel of the computer using a DE-9 connector.

The following pictures illustrate various options for connecting the game socket to a breadboard. Keep track of which pins on the external connector correspond to which pins on the internal connector. On the Apple //gs, pin 1 is in the upper left corner of the socket. For all other Apples, pin 1 is in the lower right corner of the socket. Pins are numbered from pin 1 to pin 8, then pin 9 is on the opposite side of pin 8, then pins 9-16 are numbered using the remaining pins.



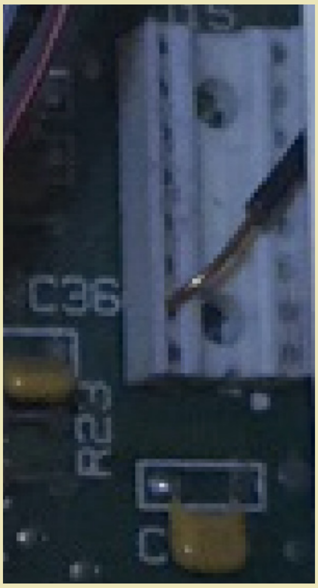


16 pin ribbon cable connection from Apple][+ Internal Game I/O socket to breadboard. Pin 1 is in the upper-right corner of the connector shown.

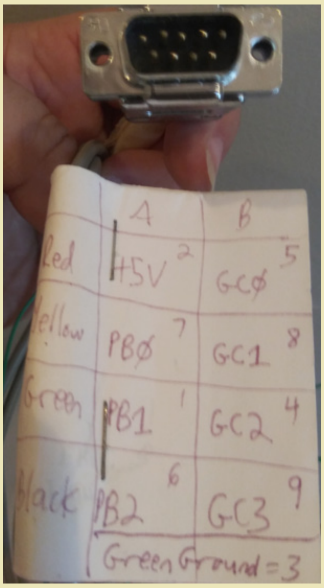


Ribbon cables connected to 2 pairs of headers: 8 pin and 6 pin. Pins 9 and 16 are not used on the Apple][+ and Apple //e, so only 6 pins are needed on one of the cables.

[Above] Ribbon cables inserted into Apple //e Game I/O socket. Note that pins 9 and 16 are unconnected.



[Left] Single wire connected to pin 15 (Annunciator 0) of Apple //e internal game socket



	A	B
Red	+5V 2	GC0 5
Yellow	PB0 7	GC1 8
Green	PB1 1	GC2 4
Black	PB2 6	GC3 9

Green Ground = 3

[RIght] Homemade DE9 cable for rear Game I/O socket of Apple //e or //gs.

by Eric Rangell

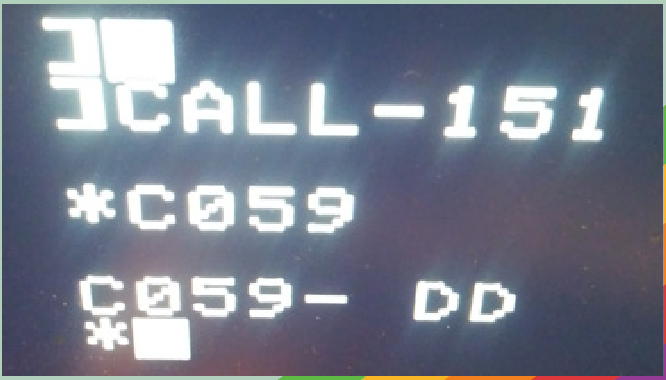
Testing your wiring

Before you proceed any further, you want to make sure all wires are properly connected and that the signals from the Apple are reaching the breadboard. While there are only 3 pins needed to build the MIDI interface project, take the time to test the additional signals available on the Internal Game I/O socket. All pin numbers below refer to pin numbers on the Internal Game I/O socket.

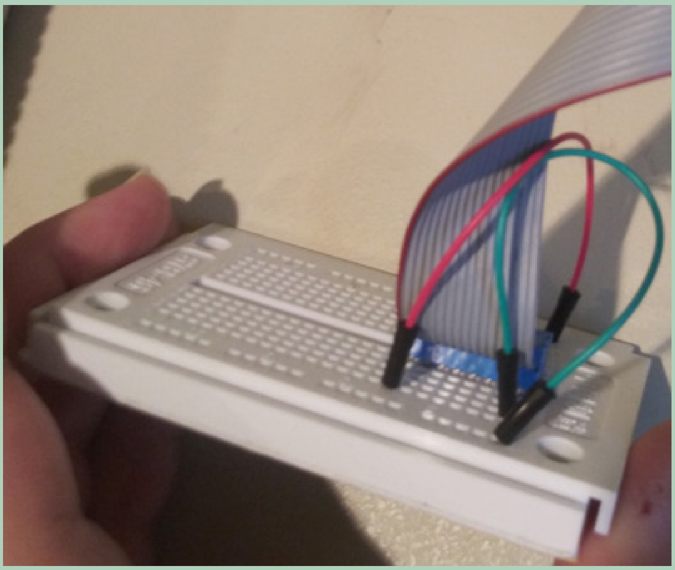
1. Test the voltage between +5V (pin 1) and GND (pin 8). Use a multimeter to verify that the voltage level coming to the breadboard is at least +5 volts. The red wire connects pin 1 to the side holes for Power and the green wire connects pin 8 to side holes for Ground. Connect the probes of the multimeter to the Power and Ground of the breadboard, and set the dial to measure voltage.

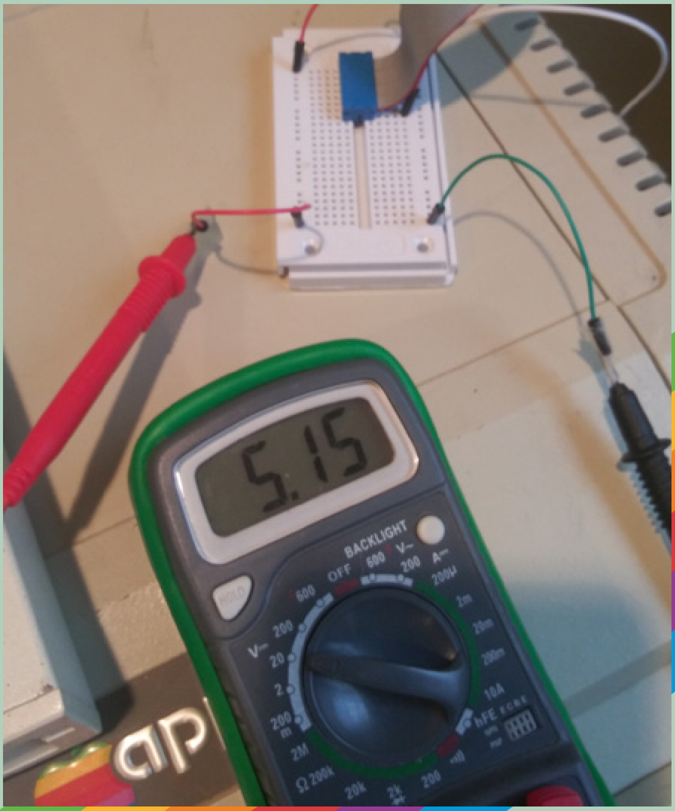
2. Test the digital logic from the Annunciator outputs. Each of the 4 Annunciator outputs is controlled by a pair of soft-switches which are mapped to memory locations. One of each pair sends a digital HIGH signal to the output, and the other soft-swich of the pair sends a digital LOW signal.

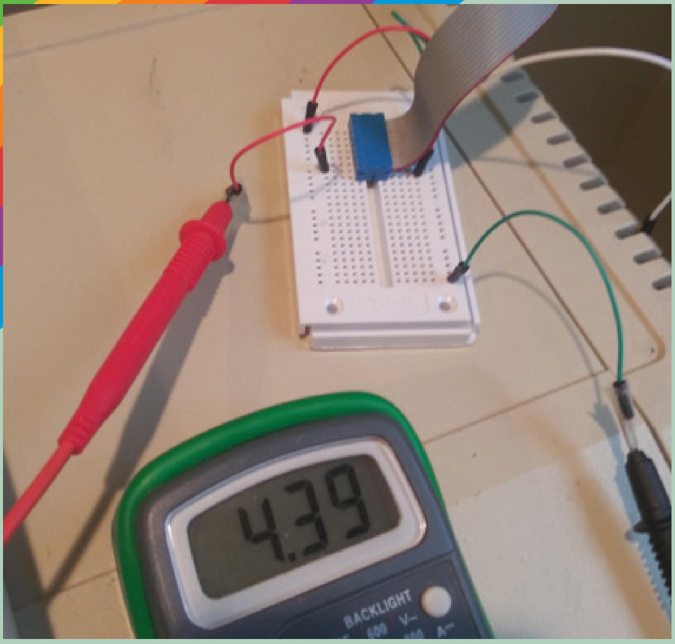
To test the HIGH signal for Annunciator #0 (pin 15) go into the Apple Monitor by typing CALL -151 from Basic, and enter the hex address: C059, as shown below. The Apple will return a value for that memory location, which you can ignore. Now you can test to verify that Pin 15 has a HIGH signal.



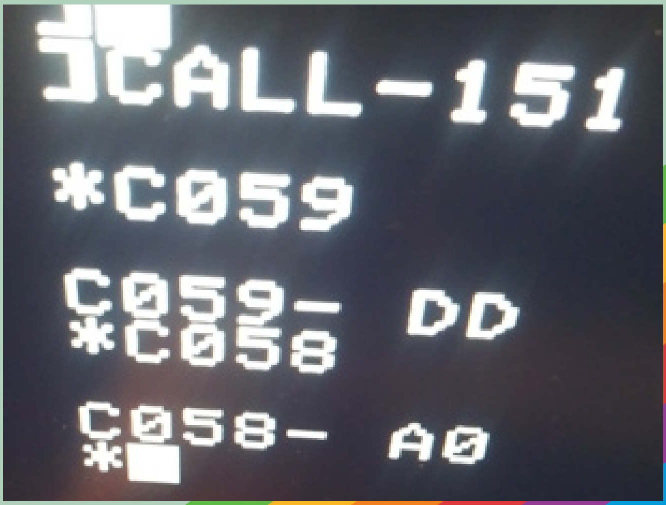
```
]
]CALL-151
*C059
C059- DD
*
```



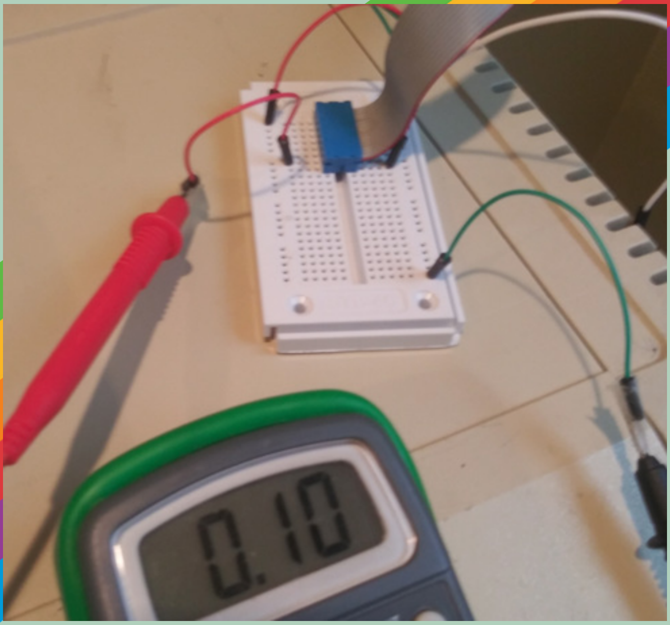


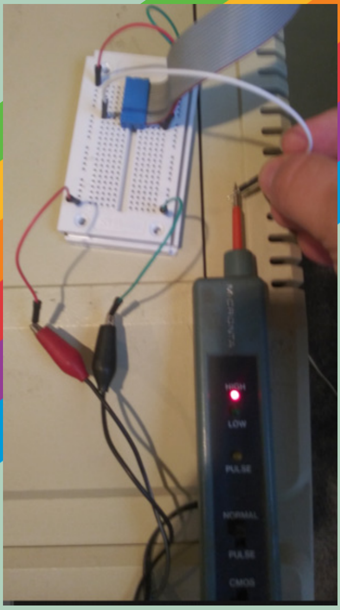


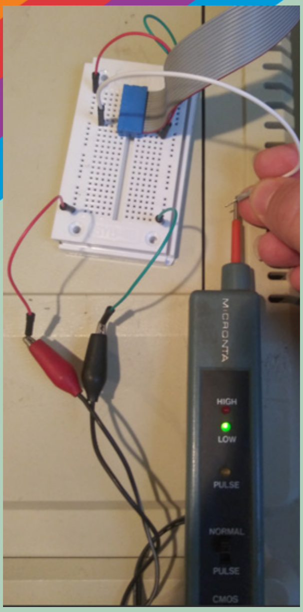
While the multimeter is connected, enter the hex address: C058 in the Apple Monitor. The voltage should drop to a very low value.



```
]CALL-151
*C059
C059- DD
*C058
C058- A0
*
```





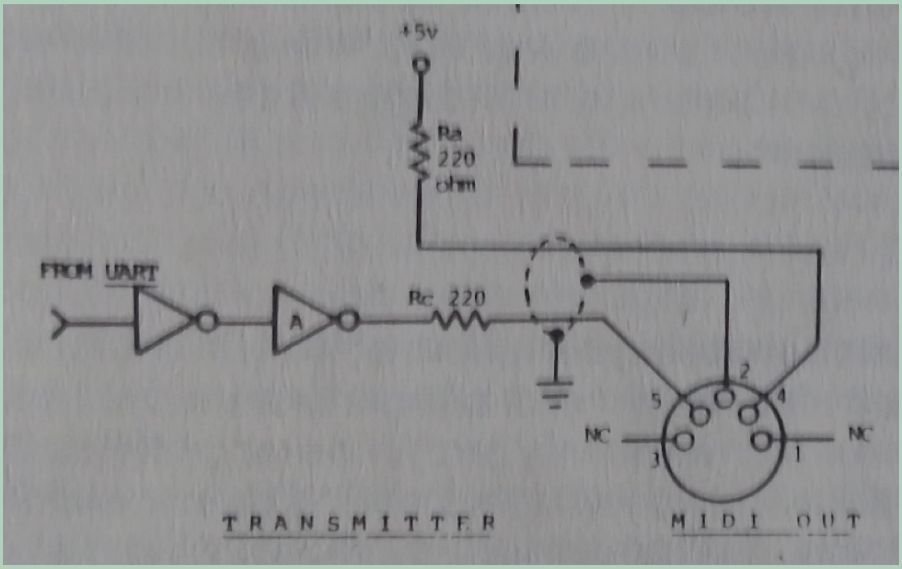


You can also test the logic of the Annunciators using a Digital Logic Probe, as shown left. Connect the probe terminals to the +5V and GND signals on the breadboard, then touch the tip of the probe to the Annunciator pin. The photos below show how the Digital Logic Probe responds when it detects logical HIGH and logical LOW voltages on Annunciator 0.

Inverters and Buffers

The MIDI specification defines the MIDI OUT Circuit as follows:

The signal from the transmitting device (labeled UART in the diagram below-left) passes through 2 inverters, then a 220 Ohm resistor, and is sent to Pin 5 on the circular 5 pin DIN connector labelled MIDI OUT. The +5V signal is sent through a 220 Ohm resistor to Pin 4 of the MIDI OUT connector. Pin 2 is connected to Ground, and the shield of the MIDI cable. Pins 1 and 3 are not connected. Polarity matters because a MIDI cable will connect your MIDI OUT port to the MIDI IN port of a musical instrument. The signals sent on your MIDI OUT port need to drive a phototransistor inside an opto-isolator in the MIDI IN circuit. When the signal from the UART is negative, the current loop is completed and the opto-isolator receives the signal. Communication is established by following a timing protocol for flipping the signals to represent the bits and bytes of MIDI messages. In this project we will control the timing of the messages with the Apple's 6502 timing, to illustrate that there is nothing magical going on – if we get the timing right and follow the protocol, we will successfully communicate with a MIDI instrument.

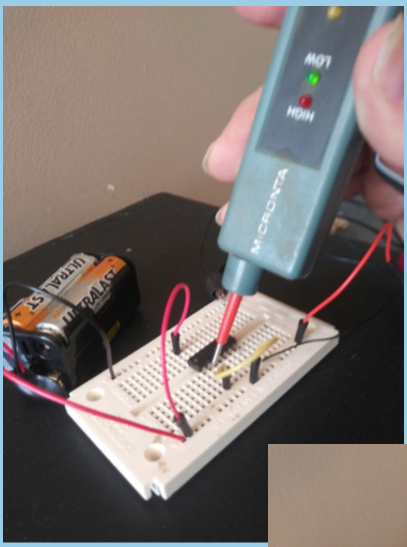


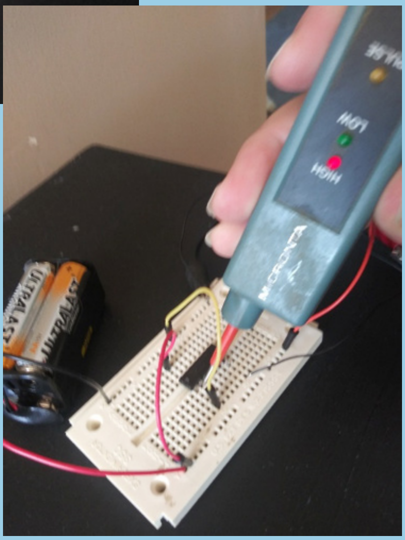
Source: International MIDI Association, Document No. MIDI-1.0, August 5, 1983.

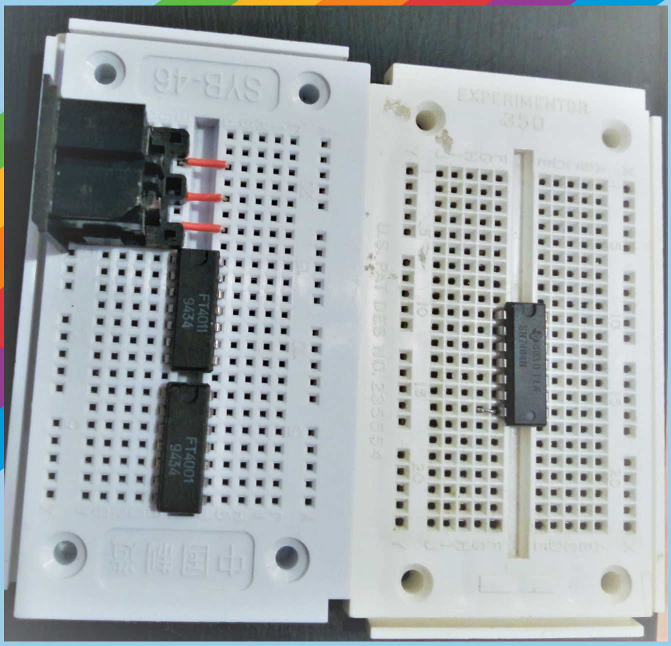
Inverters change the input signal from HIGH to LOW, or LOW to HIGH. So, two inverters will leave the input signal unchanged. The two inverters form a buffer, which ensures that the signal does not get degraded if voltage fluctuates due to additional loads on the circuit. While it may be possible to drive the signal directly from the Apple without using the buffers, that introduces an element of uncertainty that can make your device unreliable under certain conditions. So initially we will build the circuit with two inverters (following the MIDI spec), and then test modifying it to use only one inverter (by logically inverting all the signals sent by the driver software).

Testing your chips

Use a logic probe to verify the outputs of each chip for each set of possible inputs. Use batteries or an electronics kit to test the chips before you use them in your project. The photos below show how one inverter of a 7404 Hex Inverter chip can be tested with a logic probe. The probe's +5V and GND alligator clips are connected to the corresponding buses on the breadboard. The probe tip then is touched to the logic gate output. In the left photo, pin 1 (the yellow wire) is connected to +5V, so the logic probe reads LOW on pin 2. In the right photo, pin 1 is connected to GND, so the logic probe reads HIGH on pin 2. For both circuits, Pin 7 is connected to GND and pin 14 is connected to +5V.







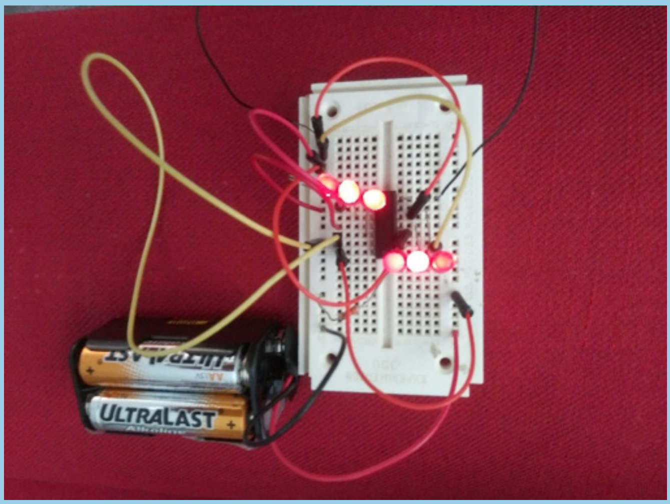
There are several integrated circuit chips that can be used to build the buffer needed for this circuit:

4001: QUAD NOR – contains 4 NOR (NOT OR) gates

4011: QUAD NAND – contains 4 NAND (NOT AND) gates

7404: HEX INVERTER – contains 6 inverter circuits.

The two breadboards above show the three chips that may be used for this project. The left breadboard shows the 4011 chip on top and 4001 chip on the bottom. The right breadboard shows the 7404 chip. A MIDI socket from Sparkfun is shown at the top of the left breadboard, with 3 jumpers connecting the terminals for pins 2, 4, and 5 to the holes on the right. If you use the 4011 or 4001 chip, connect both inputs of each gate together to create inverters from the NAND or NOR gates. Search for pinouts and datasheets for each of these chips to learn how they should be connected in circuits.



In the photo at the bottom-right of the previous page, all 6 outputs of the 7404 chip are connected to LEDs, and all inputs to each of the 6 gates are connected to GND. All 6 LEDs light up because all outputs are HIGH. The TTL logic in the chip amplifies the current and provides +5V on each output which drives each LED. A buffer circuit can be made with 2 inverters by connecting the output of one inverter to the input of the other. Note that for some logic chips, all unused inputs must be connected to GND for the circuit to work.

MIDI Output Circuit Assembly

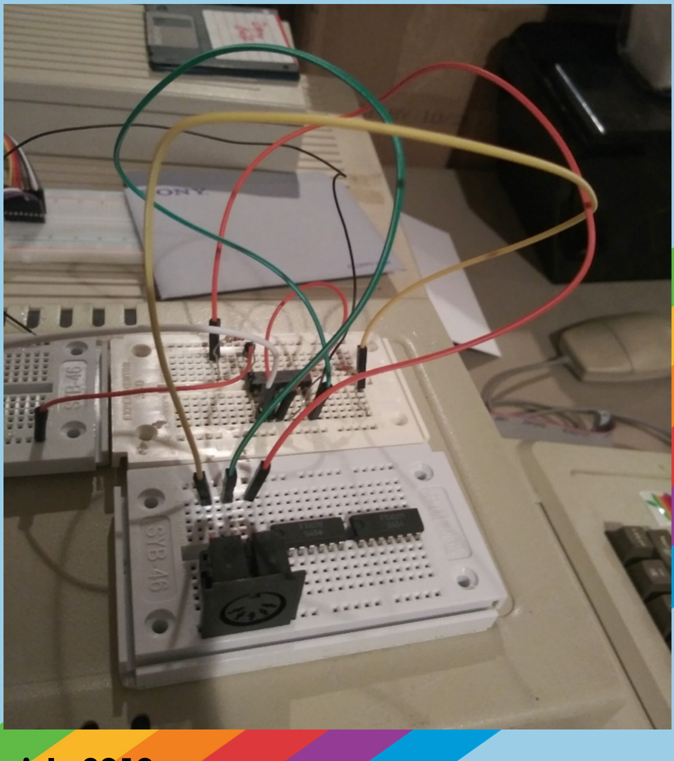
The following diagrams show how you would connect the Apple Game I/O connector to a 7404 Hex Inverter chip. Make sure power to your Apple is OFF while you are making these connections.

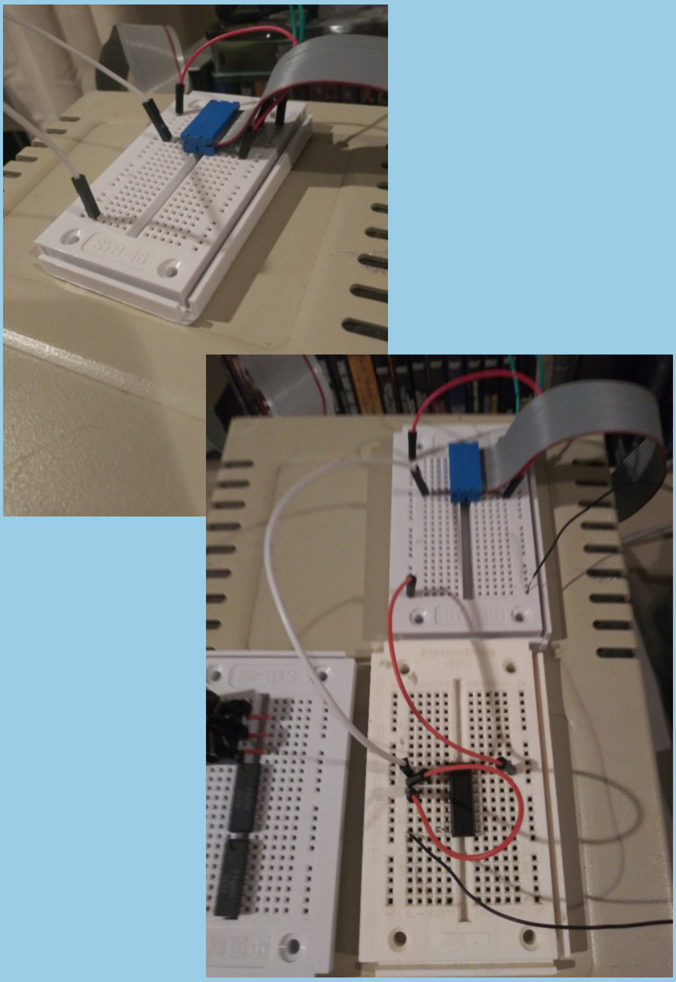
1. Apple Pin 1 (+5V), on bottom right of blue connector goes to +5V bus on breadboard, and to pin 14 of the 7404 chip (upper right pin – red wire).

2. Apple Pin 8 (GND) on top right of blue connector goes to GND bus on breadboard, and to pin 7 of the 7404 chip (lower left pin – black wire).

3. Apple Pin 15 (AN0) on the pin above the lowest pin on the lower left of the blue connector goes to Pin 1 of the 7404 chip (Inverter IN, upper left pin, white wire).

4. Pin 2 of the 7404 chip (Inverter OUT) is connected to Pin 3 (Inverter IN), red wire.





5. Connect a 220 ohm resistor to Pin 4 (Inverter OUT) of the 7404 Inverter, then connect the other end of the resistor to Pin 5 of the MIDI socket (Yellow wire). The holes of the MIDI socket are on the bottom, so the pins shown left to right in the photo below are 5, 2, 4.

6. Connect a 220 ohm resistor to Pin 14 of the 7404 Inverter (+5V). Then connect the other end of the resistor to Pin 4 of the MIDI socket (Red wire).

7. Connect Pin 2 of the MIDI socket to Pin 7 of the 7404 Inverter (GND).

8. Connect a MIDI cable from the MIDI socket to your MIDI instrument. The MIDI instrument needs to have a round 5 Pin DIN port labelled MIDI IN (or “to MIDI OUT”).

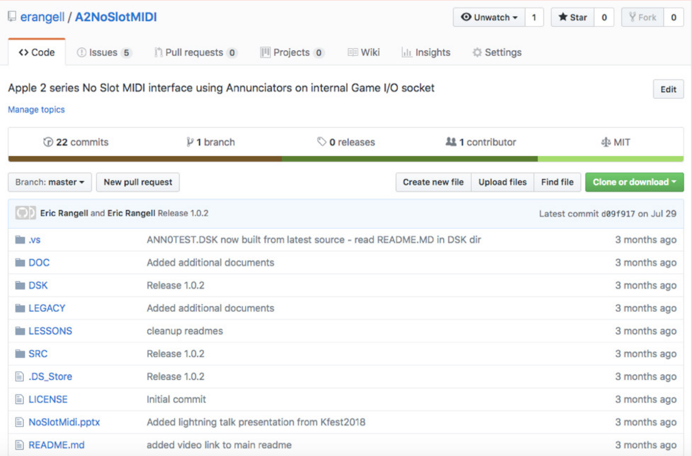
Testing your MIDI Interface

You have built the hardware for the interface and connected it to your Apple. How will the Apple communicate with the interface? It needs a driver program to control the electronics of the interface. For this interface, the driver will send HIGH and LOW signals from the Annunciator output at precise times which will be interpreted by your MIDI instrument as commands. A communication protocol is needed – an agreement of what signals will be sent when, how they should be interpreted, and how the musical instrument should behave when specific commands are received. This protocol is documented in the MIDI specification, and many other resources available online.

Where will the driver software come from? Apple][computers used floppy disks to load software. If your Apple has a 5.25 inch floppy disk drive, you can create a disk from a disk image file using software such as ADT Pro. Or if you have a hardware device such as the Floppy Emu, you can copy a disk image file to a Micro SD card and load the disk image from the device. The disk image containing the driver software for this MIDI interface can be downloaded from Github at:

https://github.com/erangell/A2NoSlotMIDI

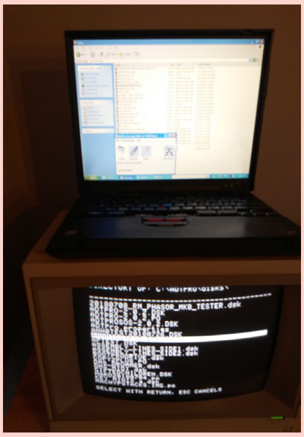
Click the “Clone or Download” button and download the whole project as a ZIP file.



Apple 2 series No Slot MIDI interface using Annunciators on internal Game I/O socket

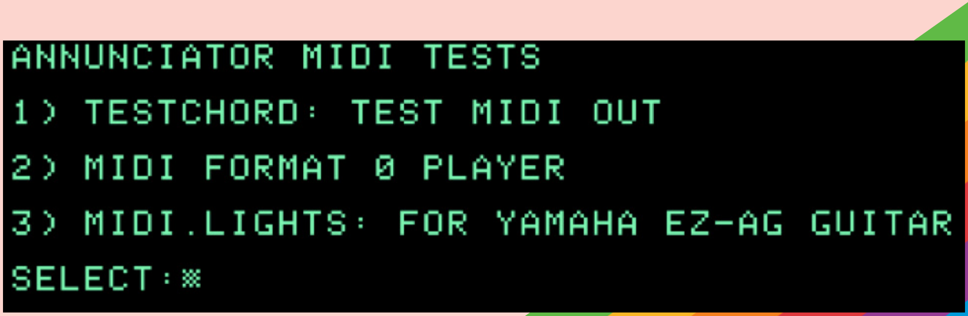
Eric Rangell and Eric Rangell Release 1.0.2 — Latest commit d09f917 on Jul 29

.vs	ANN0TEST.DSK now built from latest source - read README.MD in DSK dir	3 months ago
DOC	Added additional documents	3 months ago
DSK	Release 1.0.2	3 months ago
LEGACY	Added additional documents	3 months ago
LESSONS	cleanup readmes	3 months ago
SRC	Release 1.0.2	3 months ago
.DS_Store	Release 1.0.2	3 months ago
LICENSE	Initial commit	3 months ago
NoSlotMidi.pptx	Added lightning talk presentation from Kfest2018	3 months ago
README.md	added video link to main readme	3 months ago



The disk image containing the driver software is located in the DSK subdirectory and is named ANN0TEST.DSK. You will need to either create a floppy disk from this disk image or copy the file to an SD card for a hardware floppy disk emulator device. The photo below shows how a floppy disk image file on a Windows laptop (in C:\ADTPRO\DISKS) can be copied to an Apple 5.25 floppy disk using ADT Pro over a Serial cable connected to an Apple Super Serial Card. For more information, please visit:

www.adtpro.com



```
ANNUNCIATOR MIDI TESTS
1) TESTCHORD: TEST MIDI OUT
2) MIDI FORMAT 0 PLAYER
3) MIDI.LIGHTS: FOR YAMAHA EZ-AG GUITAR
SELECT:
```

When you boot the floppy disk on the Apple where you connected your MIDI interface you will see the menu above.

Select option 1 to test playing a chord on your MIDI instrument.

```
Press Return to play the chord:
Press Return to stop the chord:

]
```

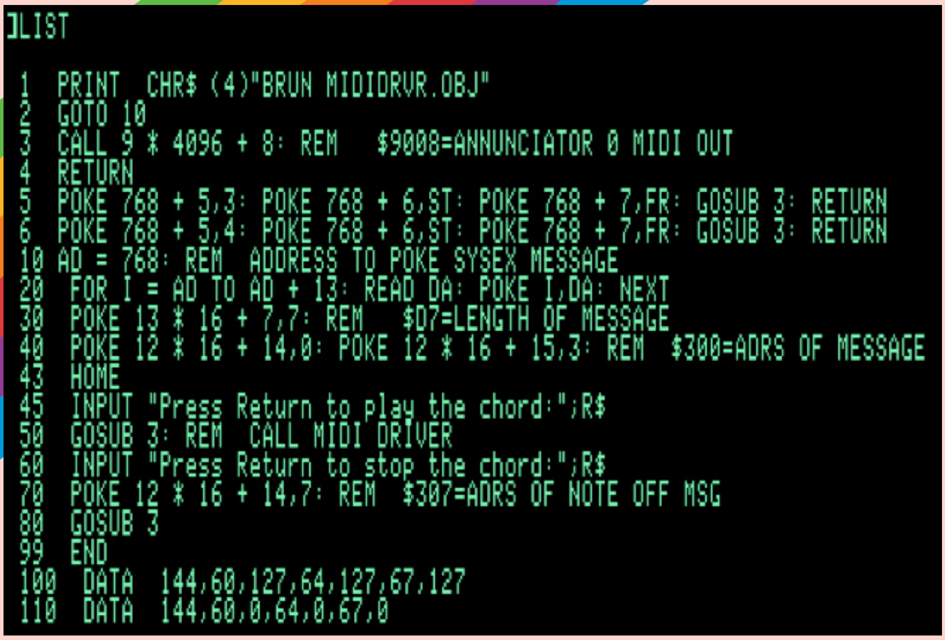
If you hear the chord play, give yourself a big pat on the back! You built an electronic device that successfully connected a vintage Apple computer to an electronic musical instrument using MIDI!

If you did not hear the chord play, take a break and plan your troubleshooting strategy.

If you are using an Apple IIgs it needs to be running at Normal speed (1Mhz). This is done in the Control Panel.

Otherwise, look at your electronic connections and see if there are any incorrectly connected wires, incomplete circuits, or shorts. Take the time to test to see if enough current is getting to the logic chip. Sometimes you have to step back, undo some work, and even start over. Learn to work through frustration, make observations, and use the scientific method to deduce what is happening.

When you have your interface working, take a look at the BASIC program that played the chord.



```
]LIST

 1  PRINT  CHR$ (4)"BRUN MIDIDRVR.OBJ"
 2  GOTO 10
 3  CALL 9 * 4096 + 8: REM   $9008=ANNUNCIATOR 0 MIDI OUT
 4  RETURN
 5  POKE 768 + 5,3: POKE 768 + 6,ST: POKE 768 + 7,FR: GOSUB 3: RETURN
 6  POKE 768 + 5,4: POKE 768 + 6,ST: POKE 768 + 7,FR: GOSUB 3: RETURN
 10 AD = 768: REM  ADDRESS TO POKE SYSEX MESSAGE
 20  FOR I = AD TO AD + 13: READ DA: POKE I,DA: NEXT
 30  POKE 13 * 16 + 7,7: REM   $D7=LENGTH OF MESSAGE
 40  POKE 12 * 16 + 14,0: POKE 12 * 16 + 15,3: REM  $300=ADRS OF MESSAGE
 43  HOME
 45  INPUT "Press Return to play the chord:";R$
 50  GOSUB 3: REM  CALL MIDI DRIVER
 60  INPUT "Press Return to stop the chord:";R$
 70  POKE 12 * 16 + 14,7: REM  $307=ADRS OF NOTE OFF MSG
 80  GOSUB 3
 99  END
 100  DATA  144,60,127,64,127,67,127
 110  DATA  144,60,0,64,0,67,0
```

Line 1 executes the binary file named MIDIDRVR.OBJ. This file contains the Machine Language instructions that control the switching of the Annunciator output using specific timings based on the MIDI Wire protocol specification. Line 2 then skips over the subroutines on lines 3, 5, and 6.

Line 3 calls a subroutine in the driver which sends MIDI data out of the interface.

Lines 5 and 6 can be ignored – they are left over from another program that controls LEDs on a MIDI guitar fretboard. You can also ignore the comment on line 10 – it is the guitar program uses MIDI SysEx messages.

Lines 10 and 20 poke the MIDI data to be sent into a free memory block. There are 14 bytes of data on lines 100 and 110 that will be stored. This data contains MIDI messages that control playing of notes on the instrument.

Line 30 tells the driver that 7 bytes (the data on line 100) should be sent when we call the driver. The number 7 is poked at memory address $D7 (13*16+7).

Line 40 tells the driver where in memory it should find the 7 bytes we want to send. The address 768 = 3 * 256. In hexadecimal, it is written as $0300. The low byte of the address ($00) is poked first at hex address $CE (12*16+4), and the high byte ($03) is poked at $CF (12*16+15).

Lines 43-45 print a prompt message and wait for the user to press the Return key.

Line 50 calls the subroutine on line 3 to send the MIDI data to the driver. The chord then begins to play.

Line 60 prompts the user to press Return, and then waits for user input. The chord continues to play.

Line 70 changes the address of the MIDI message to $0307, so it now points to the data from line 110, which contains the MIDI instructions to stop each note of the chord.

Line 80 calls the subroutine on line 3 to send the MIDI data to the driver. The chord then stops playing.

Line 99 ends the program. Type RUN to run it again.

The data on line 100 is explained below:

144, 60, 127 = MIDI NOTE ON message, Note #60 = Middle C, 127 = maximum volume

64, 127 = MIDI NOTE ON message, Note #64 = E above Middle C, 127 = maximum volume.

Whenever a series of MIDI messages have the same command (ex: 144 = Note on), the command byte can be omitted. This is known as "Running Status". The note number for E is 64 because on a piano keyboard the note E is 4 semitones above C. So if C is 60, C#=61, D = 62, D#=63, and E=64.

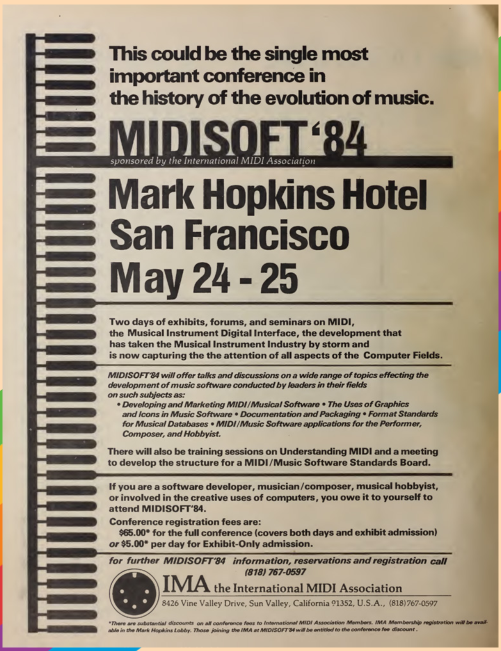
67, 127 = MIDI NOTE ON message, Note #67 = G above Middle C. If we start counting at E=64, then F=65, F#=66, and G=67.

The data on line 110 is explained below:

144, 60, 0 = MIDI NOTE ON message, Note #60 (middle C), 0 = minimum volume (no sound). When a NOTE ON message has a volume of 0, it is essentially a NOTE OFF message. (Note: There is a separate MIDI NOTE OFF message which can be used in place of this message, which will have the same effect).

64, 0 = turns off the E that was playing.

67, 0 = turns off the G that was playing.



This could be the single most important conference in the history of the evolution of music.

MIDISOFT '84

sponsored by the International MIDI Association

Mark Hopkins Hotel
San Francisco
May 24 - 25

Two days of exhibits, forums, and seminars on MIDI, the Musical Instrument Digital Interface, the development that has taken the Musical Instrument Industry by storm and is now capturing the the attention of all aspects of the Computer Fields.

MIDISOFT'84 will offer talks and discussions on a wide range of topics effecting the development of music software conducted by leaders in their fields on such subjects as:

• Developing and Marketing MIDI/Musical Software • The Uses of Graphics and Icons in Music Software • Documentation and Packaging • Format Standards for Musical Databases • MIDI/Music Software applications for the Performer, Composer, and Hobbyist.

There will also be training sessions on Understanding MIDI and a meeting to develop the structure for a MIDI/Music Software Standards Board.

If you are a software developer, musician/composer, musical hobbyist, or involved in the creative uses of computers, you owe it to yourself to attend MIDISOFT'84.

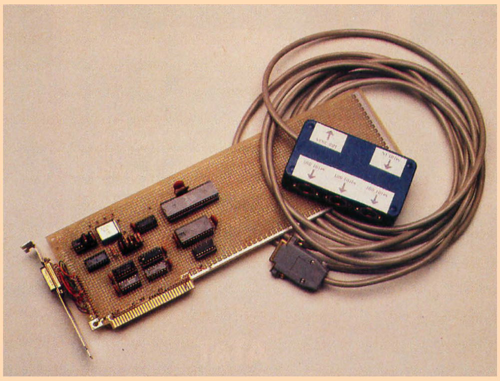
Conference registration fees are:
$65.00* for the full conference (covers both days and exhibit admission)
***or* $5.00* per day for Exhibit-Only admission.**

for further MIDISOFT'84 information, reservations and registration call
(818) 767-0597

IMA the International MIDI Association
8426 Vine Valley Drive, Sun Valley, California 91352, U.S.A., (818)767-0597

**There are substantial discounts on all conference fees to International MIDI Association Members. IMA Membership registration will be available in the Mark Hopkins Lobby. Those joining the IMA at MIDISOFT'84 will be entitled to the conference fee discount.*

MIDI was a large advance for the music industry. Computers or sequencers could be used to record performance data, and the instruments could be changed later, or the music re-arranged. This meant a need for fewer 'takes' as they no longer had to be absolutely perfect.



However, to take advantage of the new standard, you needed an interface for your computer. Other projects for MIDI interfaces often involved expansion cards. This one does not.

A MIDI PROJECT

BY JAY KUBICKY

A MIDI *interface with software for the* IBM PC

BEFORE I DESCRIBE my project, I'd like to discuss the MIDI specification. This standard defines a hardware interconnection scheme with a software specification for the purpose of connecting electronic musical instruments to a computer.

As the name implies, an electronic musical instrument is any instrument that produces sound electronically. The most common electronic musical instrument is the synthesizer. The first synthesizers looked like part of a piano keyboard attached to a long, flat box covered with dials and switches. But today there are many other forms; a modern synthesizer might well have no keyboard but might have a MIDI-in jack.

All synthesizers produce sound through a system of oscillators, filters, and other wave-shaping devices. One way to classify synthesizers is by the number of voices they have. At any given instant, each voice can produce one individual note. For example, an eight-voice synthesizer can produce eight simultaneous notes. In synthesizers with multitimbral capability each of these voices can produce a different sound.

On a modern synthesizer, the control values of the voices are stored within the synthesizer in what are known as "patches" or "programs." These programs hold all of the values for each sound the synthesizer can produce. Different sounds can be loaded into the synthesizer's sound-generating circuitry by changing the program. Most synthesizers can store from 32 to 128 programs.

Sequencers are a particularly interesting class of devices associated with MIDI interfaces. These allow you to store sequences of notes played from a MIDI-compatible keyboard or other MIDI device. Since only the codes for the notes are stored and not the actual notes, the sequencers can later play back this music at any speed without altering the pitch.

Besides synthesizers, MIDI also ties together drum machines, guitar synthesizers, and other MIDI-compatible devices.

THE MIDI PROTOCOL

The MIDI protocol is a complex set of messages pertaining, in general, to various functions of the MIDI system, and, in particular, to functions of synthesizers.

Two types of bytes can be sent over the MIDI interface bus—status and data. Status bytes are 8-bit bytes with their most significant bit being bit 7, always set to 1. Data bytes may never have their MSBs set.

Messages are made up of a combination of these two types of bytes. The status byte is sent first, and usually it is followed by one or more data bytes. Real-time messages have no accompanying data bytes and may be sent at any time, even inside of other messages.

MIDI messages are generally divided into two types—channel messages and system messages. The channel voice messages are an important subset of the channel messages. They are used to alter the status of the synthesizer's voices.

The *note-on* channel voice message is sent whenever a key is pressed. The data bytes in this message specify the number of the note and its velocity, which is determined by how hard the key was struck (this only applies to velocity-sensitive keyboards). The *note-*

(continued)

Jay Kubicky (934 North Orange St., Media, PA 19063) is a high school sophomore. He has studied music since age five and has been interested in computers for five years.

JUNE 1986 • BYTE 199

Now it is your turn to experiment with this program and learn about MIDI as you go.

Try adding the following lines:

```
            75 POKE 13*16+7, 3
         82 INPUT "PRESS RETURN";R$
      84 POKE 13*16+7,2: POKE 12*16+14,10: GOSUB 3
   86 INPUT "PRESS RETURN";R$
88 POKE 12*16+14,12: GOSUB 3
```

RUN the program. What does it do now? Take notes of your observations and experiment with the code. Change the data to play different notes. How would you play the same notes one octave higher or lower? Have fun changing the program to play your favorite song. Try writing subroutines to play a sequence of notes and calling the subroutines several times.

Also, try running the MIDI FORMAT 0 PLAYER PROGRAM (option 2 on the main menu). When prompted for the MFF0 file to play, enter PEANUTS0.MID as shown below. Then press RETURN to play the music. Note: this program requires 80 columns and 128K of memory.

```
APPLE //e MIDI FILE FORMAT 0 PLAYER - WITH MIDI KARAOKE

(c) 1995 - Eric Rangell

(Press RETURN to see catalog of /MIDI volume.)


MFF0 FILE TO PLAY:PEANUTS0.MID


OPTIONS: L=Lyrics off  S=Speed display on
         I=Inverse Piano  O=Piano Off  P=Piano Keys inverse
         K=Karaoke Look Ahead  M=Set init speed

Enter options, then press RETURN to start the music:
```

You will see the note names displayed on the 80 column screen as the music plays.

The following screenshot shows a D major chord being played. The uppercase F indicates an F# note.

```
                      d                   d   F  a   d
2          d
3          d
4
```

This program is a combination of Applesoft and Machine Language code that uses the same driver program for the MIDI interface.

MIDI PROJECT

any time, even between the bytes of another message. These messages control timing and synchronization of the system and are especially impor-

manual control only. It should not be sent automatically on power-up.

SYSTEM-COMMON MESSAGES

priate manufacturer identification is sent, any amou[illegible] can be sent over the bus (just as long as the MSBs of all data bytes are set

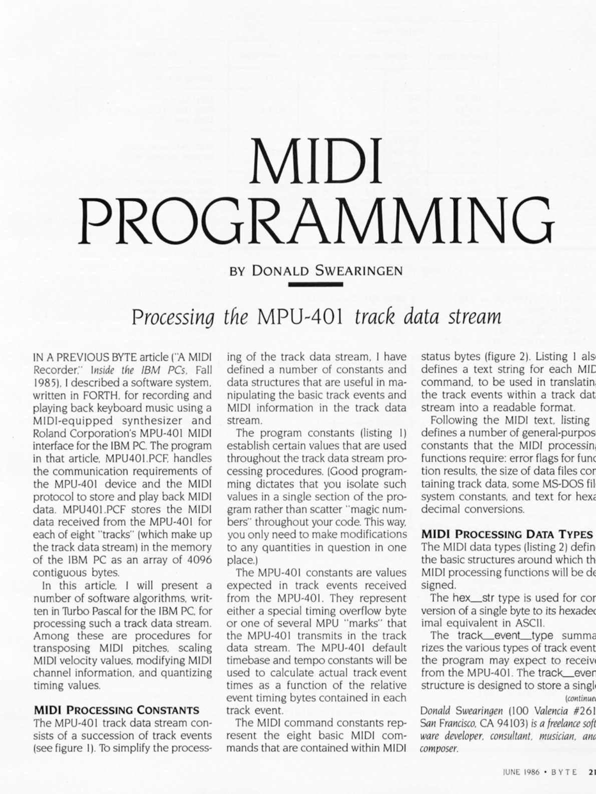
You now see how there is a separation of Application code from Driver code for the hardware. The Application code handles the loading of music data from the song file on disk, the timing of when the musical notes should be sent (based on the data in the file), and the display of the notes that are being played. The Driver handles all communication with the hardware.

The same principles are used in modern computer applications. When you install a peripheral on a modern computer, such as a printer, it needs a driver program in order for the computer to communicate with the hardware. The application software then needs to know how to communicate with the driver to make it perform high level tasks, such as printing a document.

This project shows you that there is no magic inside the computer – it is all electronic circuits following instructions using protocols to communicate with other electronic components. Everything happens very fast with precision timing, and you can see how an error anywhere in the process can make things appear not to work, but the computer is just following the exact instructions that it is given. Programmers need to anticipate all possible error conditions and make sure their code handles them properly. Sometimes problems occur due to unexpected sequences of events or timing issues.

In future articles, we will look at the machine language driver code to understand how it communicates with the hardware, and explore advanced concepts such as using interrupts to improve the timing accuracy of music playback. If you understand assembly language and want to look at it yourself, go to the SRC directory on the Github site and look at the file: main.s in the A2NoSlotMidi subdirectory. Read the comments and try to understand how the program works. Then experiment with it. You have built your own MIDI interface and now have everything you need to build your own applications with it.

Welcome back to the exciting 1980's world of vintage Apple][programming!



MIDI PROGRAMMING

BY DONALD SWEARINGEN

Processing the MPU-401 *track data stream*

IN A PREVIOUS BYTE article ("A MIDI Recorder," *Inside the IBM PCs*, Fall 1985), I described a software system, written in FORTH, for recording and playing back keyboard music using a MIDI-equipped synthesizer and Roland Corporation's MPU-401 MIDI interface for the IBM PC. The program in that article, MPU401.PCF, handles the communication requirements of the MPU-401 device and the MIDI protocol to store and play back MIDI data. MPU401.PCF stores the MIDI data received from the MPU-401 for each of eight "tracks" (which make up the track data stream) in the memory of the IBM PC as an array of 4096 contiguous bytes.

In this article, I will present a number of software algorithms, written in Turbo Pascal for the IBM PC, for processing such a track data stream. Among these are procedures for transposing MIDI pitches, scaling MIDI velocity values, modifying MIDI channel information, and quantizing timing values.

MIDI PROCESSING CONSTANTS

The MPU-401 track data stream consists of a succession of track events (see figure 1). To simplify the processing of the track data stream, I have defined a number of constants and data structures that are useful in manipulating the basic track events and MIDI information in the track data stream.

The program constants (listing 1) establish certain values that are used throughout the track data stream processing procedures. (Good programming dictates that you isolate such values in a single section of the program rather than scatter "magic numbers" throughout your code. This way, you only need to make modifications to any quantities in question in one place.)

The MPU-401 constants are values expected in track events received from the MPU-401. They represent either a special timing overflow byte or one of several MPU "marks" that the MPU-401 transmits in the track data stream. The MPU-401 default timebase and tempo constants will be used to calculate actual track event times as a function of the relative event timing bytes contained in each track event.

The MIDI command constants represent the eight basic MIDI commands that are contained within MIDI status bytes (figure 2). Listing 1 als defines a text string for each MID command, to be used in translatin the track events within a track dat stream into a readable format.

Following the MIDI text, listing defines a number of general-purpos constants that the MIDI processin functions require: error flags for func tion results, the size of data files con taining track data, some MS-DOS fil system constants, and text for hexa decimal conversions.

MIDI PROCESSING DATA TYPES

The MIDI data types (listing 2) defin the basic structures around which th MIDI processing functions will be de signed.

The hex__str type is used for con version of a single byte to its hexadec imal equivalent in ASCII.

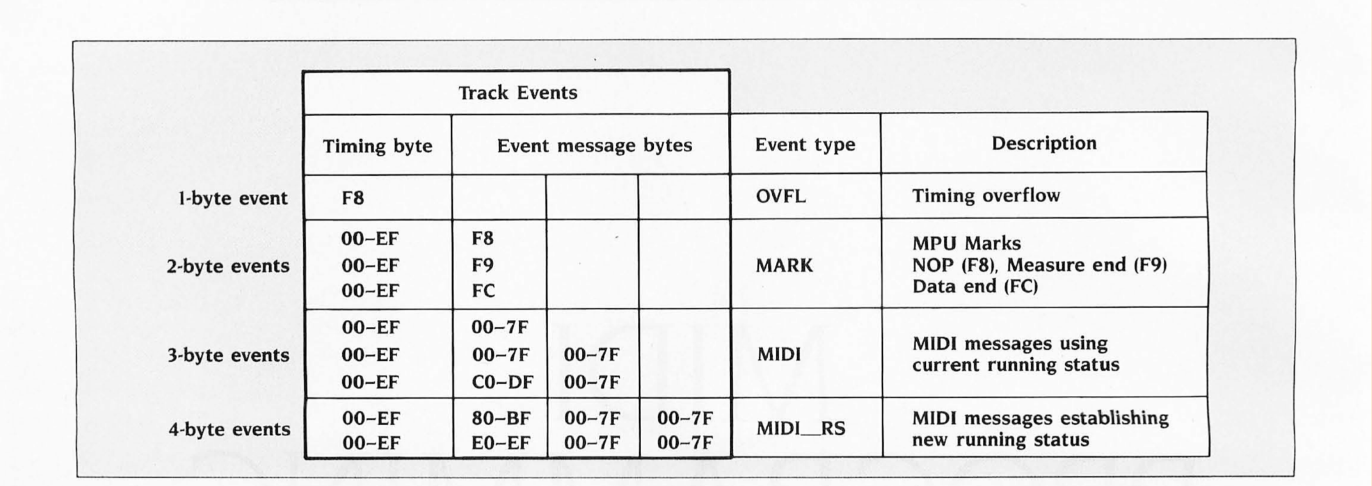
The track__event__type summa rizes the various types of track event the program may expect to receiv from the MPU-401. The track__even structure is designed to store a singl

(continue

Donald Swearingen (100 *Valencia* #261 San Francisco, CA 94103) *is a freelance soft ware developer, consultant, musician, and composer.*

JUNE 1986 • BYTE 21

```
;----------------------------------------------------------------------
; APPLE ][ SERIES ANNUNCIATOR MIDI DRIVER
; Copyright © 1998-2018 Eric Rangell. MIT License.
;----------------------------------------------------------------------;
;  main.s
;  A2NoSlotMidi
;  Created by Eric Rangell on 17 JULY 2018.
;  VERSION 1.0.1 released 26 JULY 2018
;  VERSION 1.0.2 released 29 JULY 2018
;----------------------------------------------------------------------
; THIS DRIVER IMPLEMENTS ASYNCHRONOUS SERIAL DATA TRANSMISSION
; THROUGH AN APPLE ][ ANNUNCIATOR OUTPUT PORT OF THE GAME CONNECTOR
; USING 32 CYCLES PER BIT TO ACHIEVE A 31.25K MIDI BAUD RATE.
;
; APPLE //GS USERS NEED TO RUN THIS PROGRAM IN NORMAL SPEED MODE (1MHZ)
;
; THE OUTPUT IS INITIALIZED TO A HIGH LOGIC VOLTAGE.  WHEN IT GOES
; LOW FOR 32 MICROSECONDS, THAT INDICATES THE START BIT OF A MIDI BYTE.
; THEN 8 BYTES OF DATA ARE TRANSMITTED, FOLLOWED BY A HIGH STOP BIT.
; THE DATA BYTES REPRESENT MIDI MESSAGES WHICH CAN BE INTERPRETED BY
; ANY MUSICAL INSTRUMENT THAT IMPLEMENTS MIDI.
```



	Track Events					
	Timing byte	Event message bytes			Event type	Description
1-byte event	F8				OVFL	Timing overflow
2-byte events	00–EF	F8			MARK	MPU Marks NOP (F8), Measure end (F9) Data end (FC)
	00–EF	F9				
	00–EF	FC				
3-byte events	00–EF	00–7F			MIDI	MIDI messages using current running status
	00–EF	00–7F	00–7F			
	00–EF	C0–DF	00–7F			
4-byte events	00–EF	80–BF	00–7F	00–7F	MIDI__RS	MIDI messages establishing new running status
	00–EF	E0–EF	00–7F	00–7F		

Figure 1: *The* MPU-401 *track data stream consists of track events, which may be one of four types and may be from* 1 *to* 4 *bytes long.*

The MSX Micro that's paid its musical dues

Yamaha manufacture probably the most successful range of electronic musical instruments in the world. Their new CX5M Music Computer is no exception.

The CX5M is a fully-fledged MSX micro-computer offering the exciting advantages of its breed; an ever-growing array of standardised software, 16-colour graphics, cassette and printer interfaces, twin joystick ports and expansion slot.

But that's not all.

Inside the CX5 is a polyphonic, programmable FM Digital synthesiser that can be played with its own music keyboard or, via its industry-standard MIDI port, control a network of compatible musical equipment.

In 1984 Yamaha's DX Series FM Synthesizers revolutionised the voice of music synthesis with their stunning reproduction of natural and electronic sounds. Now the CX5 gives you that same musical fidelity simply by hooking-up through your TV monitor or Hi-Fi system. For the first time a computer is a real musical instrument.

Yamaha also offer a number of music-based software ROMs. Music Macro for instance is designed specifically for the computer hobbyist. It enables you to access the CX5's superb FM sounds from MSX BASIC and from this, program games and AV sequences using music and sound effects.

Or try the FM Music Composer Program which provides an on-screen musical stave for fully expressive, computer assisted composition and arrangement.

So when you've completed your modern day answer to Beethoven's piano concerto ... you could always start cataloguing your record collection, work out your home accounts and discover why you have that overdraft at the bank, or even just sit back and play the latest arcade game!

Yamaha CX5M - Outline Features

- CPU - Z80A; 32K ROM; 32K RAM; 16K VRAM
- 16-colour graphics
- MIDI (Musical Instrument Digital Interface)
- Programmable FM voice generator (46-voice, 8-octave, 8-note poly)
- Music keyboard split & swap - voice and mono poly)
- 8-voice multi-timbral
- Built-in real-time performance recorder
- Auto accompaniment with rhythm
- Yamaha Software ROMs:
  FM Music Macro
  FM Music Composer
  FM Voicing Program
  DX7 Voicing Program
  (Coming Soon)
  RX Rhythm Editor
  4-track Real Time Sequencer
- Price: From £534rrp (CX5M + YK01 music keyboard)
- YK10 music keyboard (full-size keys) also available

Yamaha CX5M - Hearing is believing

Yamaha CX5M - 'Hearing is Believing'
FREE Demonstration tape. Fill in the coupon NOW!

See and hear the CX5M only at the following Yamaha Hi-Tech Centres.

London
Rod Argent's Keyboards, 20 Denmark St. WC2
Chappell of Bond Street, 50 New Bond St. W1
Chromatix, Oak Rd. W5
Freedmans, 629 High Rd. E11
Future Music, 202 New Kings Rd. SW6
Gigsounds, 86-88 Mitcham Lane, SW16
Gigsounds, 22 Rushey Green, SE6
London Rock Shop, 26 Chalk Farm Rd. NW1
Rose-Morris, 11 Denmark St. WC2
Soho Soundhouse, 18a Soho Sq. W1
Syco Systems, 20 Conduit Pl. W2
Addlestone: ABC Music, 14/16 High St
Barnet: ESS, 230 High St
Belfast: Baird Sound Systems, 208 York St.
Bingley: JSG Music, 104 Main St
Birmingham: Jones & Crossland, 6 Smallbrook Queensway
Musical Exchange, 89 Old Snow Hill
Blackburn: Reidy's, 9-13 Penny St.
Bournemouth: Eddie Moors Music, 679 Christchurch Rd.
Bristol: Bristol Guitar Workshop, 157 St Michael's Hill
London Rock Shop, 7 Union St.
Cambridge: Cambridge Rock, 8 Burleigh St.
Cardiff: Musicland, 148-154 North Rd.
Chelmsford: Future Music, 10 Baddow Rd.
Colchester: Axe Music, 96 High St
Croydon: Rockbottom, 74 London Rd
Derby: Derby Organ Centre 62 Babbington Lane
Dunfermline: Sound Control, Elgin St
Eastbourne: Peter Bonner, 12a Grove Rd
Edinburgh: James Grant, 53 Home St.
Exeter: City Music, 4 Stn. Cres, Queen st
Fleet: Kingfisher Music, 20 Kings Rd
Glasgow: James Grant, 404 Byres Rd, G12
McCormacks 29-33 Bath Street G2
Guildford: Andertons, 91 Haydon Place.
Hadleigh (Essex): Honky Tonk, 300 London Rd
Harrow: City Music, 14a Broadwalk
Heald Green (Cheshire): Sounds Great, 182 Wilmslow Rd
Ipswich: Axe Music, 41-3 St Nicholas St.
Leicester: Carlsbro', 22-32 Humberstone Rd
Liverpool: Frank Hessy, 62 Stanley St.
Maidstone: Sharon Music, 65 High St.
Mansfield: Carlsbro', 182 Chesterfield Rd. Nth
Middlesbrough: Guitarzan & Bongo Bill 23/27 Middlesbrough Road
Milton Keynes: Chappell of Bond St, Silbury Boulevard
Newcastle-upon-Tyne: Rock City, 10 Moseley St
Norwich: Carlsbro', 2 Sovereign Way, Anglia Sq
Nottingham: Carlsbro', 11-13 Hockley
Peterborough: Stix, 603 Lincoln Rd
Plymouth: City Music, 29-31 Eastlake St
Portsmouth: Future Music, 104-106 Elm Grove, Southsea
Romford: Music Village (BAJ) 10 High Rd. Chadwell Heath
Sheffield: Carlsbro', 720 City Rd
Slough: ABC Music, 324 Farnham Rd
Southampton: Future Music, 85 St. Mary's St.
Sunderland: White Sounds, 181 Hylton Rd
Swansea: Picton Music, 9-15 Arcade
Torquay: City Music, 65 Market St
Truro: City Music, 8 Pydar St
Warrington: Dawsons Music, 65 Sankey St.
Wolverhampton: One Way Music, 100 School St
Listing correct at time of going to press and subject to change

YAMAHA
MUSICAL INSTRUMENTS
MOUNT AVENUE, BLETCHLEY, MILTON KEYNES, BUCKS, MK1 1JE
☎ (0908) 640202 24hr Ansaphone (0908) 649222

Please send me full details about the Yamaha CX5M Music Computer and your FREE demonstration tape.
Name..
Address.......................................
....
....
DEPT JU.1
Yamaha-Kemble Music (UK) Ltd,
Mount Avenue, Bletchley, Milton
Keynes, Bucks, MK1 1JE

Loading.... Ready.... RUN

YAMAHA CX5M

MSX

By 1983 the consumer was spoiled for choice when it came to purchasing a home micro-computer.

Apple, Atari and Commodore all had their own systems in the mix, along with those from smaller companies. With so many incompatible systems on the market it was tricky for the lay person to choose a system. Do you buy an Apple knowing you cannot use software made for the Atari and Commodore computers? Do you buy a Spectrum knowing you cannot use anything developed on a BBC Micro or Tandy computer?

Enter Kazuhiko Nishi, director of the ASCII Corporation and friend to Bill Gates. Nishi-san had already assisted in the development of Japan's first attempt at standardising the computer market, the NEC PC-8001. Using a version of Microsoft BASIC, this computer helped establish NEC as the leaders in home computing. This was a title they would hold until the late 90s, when Japan decided to adopt the Western PC standard.

However, Nishi-san was not one to rest on his laurels, and four years after his success with NEC it was time to develop something new. Though the PC-8001 was designed to be a standard, there were still computers being released from other companies that were not compatible with NEC's micro. This time Nishi-san did not place all of his bets with a single company, but he instead sought to get different manufacturers on board while developing what would be known as the MSX. Once again, his friend Bill Gates was on board to help develop this new standard of computer.

Variations of the MSX were released by Sony, Philips, Casio and more. Though the core of these computers remains the same, manufacturers were welcome to add to the hardware as long as it remained compatible with the MSX standard. One such developer of MSX hardware was Yamaha, a company best known for its musical hardware.

The Yamaha CX5M, released in 1984, was marketed as a "musical computer". As well as being able to expand the computer with a printer, tape drive and other common devices, the CX5M was able to interface directly with a Yamaha musical Keyboard. With the special interface installed on the left side of the computer, you could connect to a Yamaha YK-01, YK-10 or YK-20 keyboard.

This interface, known as the SFG provided audio abilities above those of a standard MSX. The CX5M and later Yamaha computers, such as the CX11 came with an SFG-01 already installed. This device allowed the CX5M to play up to eight sounds simultaneously. Enhanced features were enabled when coupled with the YRM-501 FM Music Computer. Though designed for the CX5M, the box to the SFG module suggests it can be connected to other MSX computers through the use of the UCN-01 adapter.

The SFG module contains a ROM which allows quick access to the musical application required to use the keyboard. One simply needs to type "call music" from MSX BASIC to bring up the interface. From here the keyboard can be set to emulate various musical instruments, including a trumpet, guitar and piano. Backing tracks can be selected and the speed can be adjusted, as can the tempo and bass.

The two SFG modules that were released contain different on board chipsets. The SFG-01 features a YM2151 OPM sound chip and a YM2148 MIDI UART. It contains a 16k ROM which is unable to receive MIDI input, though it can output MIDI data to the Yamaha DX7, or similar device. The SFG-05 boasts an improved YM2164 OPP sound chip to go with its YM2148 MIDI UART. Unlike its predecessor, it features a 32k ROM which supports MIDI input. This means it is not restricted to using only a Yamaha YK keyboard.

Various cartridges were developed by Yamaha that took advantage of the SFG module. These include the aforementioned YRM-501 FM Music Composer, which also enabled you to compose your own music, and the YRM-102 FM Voicing Program which allowed you to create your own musical instruments. These instruments could then be used with the keyboard to create customs arrangements.

Unlike many MSX computers, which only saw release in Japan, the CX5M was released in the UK, US and Australia. Those who have documented the history of the computer claim that the CX5M was released in music stores, as opposed to computer hardware outlets such as Dick Smith or Tandy Electronics. These music stores would have the keyboard available for sale, as well as the computer itself. It is worth noting that the Yamaha YK keyboards are useless without an MSX CX computer with SFG interface.

LOS 20 MSX DE ESPAÑA

YAMAHA CX5M

P.V.P. 98.700 p

Especial para músicos

El Yamaha CX5M es un microordenador diseñado especialmente para músicos, compositores y arregladores que encontrarán en él una gran ayuda técnica.

Este aparato pone de manifiesto las enormes posibilidades de la norma MSX al ofrecer una opción específica para aquellos con inquietudes musicales.

Como ya detallamos en nuestro número 7-8 estamos ante un aparato cuyas principales virtudes son las de desarrollar las posibilidades de experimentación musical. Para ello cuenta con un generador programable FM de 46 voces, 8 octavas y 8 notas polifónicas y una entrada MIDI (Musical Instrumentos Digital Interface), que permite la conexión directa con un sinnúmero de instrumentos electrónicos, y una entrada especial para teclado musical.

A estas innovaciones técnicas que enriquecen el hardware de este MSX, la casa Yamaha ofrece su amplia gama de periféricos musicales y del software apropiado.

Así podemos señalar tres modelos de teclado musical, que se adaptan a las distintas necesidades y posibilidades del usuario. Junto a ellos un catálogo de software específico que incluye un compositor musical, un programa de voces FM, un cartucho Memory Data, etc.

Con este aparato ya nadie puede dudar de la amplitud de objetivos del sistema MSX.

FICHA TECNICA

Microprocesador	Z80A
Frecuencia de clock	3.58 MHz
Memoria ROM	32K
Memoria RAM	32K + 16K VRAM
Memoria usuario	29K
Precio aproximado	98.700 pts.

Distribuidor:
Hazen Distribuidora Gral. de Pianos S.A.
Ctra. de La Coruña, Km. 17,200 - Las Rozas de Madrid

Observaciones:
El Generador de Voces FM LSI es el chip YM-2151 Yamaha.

34

Hardware/Yamaha CX5M

Teclado
Contiene todas las teclas de función que normalmente se asocian al estándar MSX, incluyendo cinco teclas de función programable y un grupo de cursor

Fuente de alimentación eléctrica
Debido a las restricciones de espacio impuestas por la interface musical, está instalada junto a la placa madre principal

Conector marginal
En este conector se acopla la caja que contiene la interface musical

ROM de BASIC
Este chip retiene los 32 K del BASIC MSX

Chip de video
El ordenador contiene el chip de video TMP8255, que proporciona los 32 sprites y 16 colores de que dispone el programador

Modulador RF
Permite enchufar al ordenador un aparato de televisión común

Interface para impr
El CX5M está equipa
una puerta para imp
en paralelo compati
Centronics

Puerta para cartuch
Una puerta en parale
cartuchos permite ir
programas de músic
adicionales, además
otros cartuchos MS
estándares

Puertas para palanca mando
Al igual que otras máq
MSX, el ordenador po
un par de puertas
analógicas tipo Atari

CPU
El CX5M utiliza com
microprocesador de
bits Z80A

Chips de RAM
El CX5M posee 48 K
RAM en el interior, d
cuales hay 28 K disp
para programas en B

by Poul Monopoli

PERIFERICOS

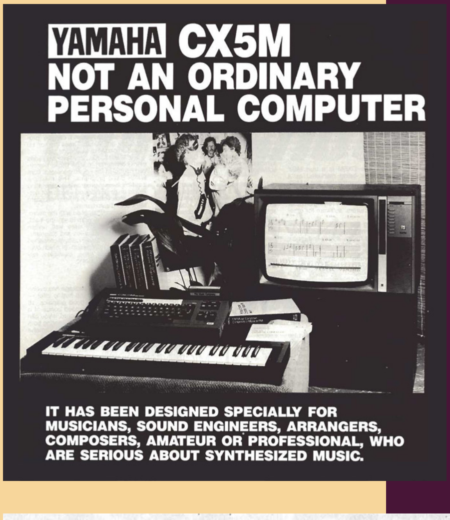
Como ampliar el sistema

por Birgitta Sandberg

Todo ordenador tiene sus limitaciones. Sin embargo, los accesorios periféricos rompen estas barreras y hacen que cada aparato ofrezca una mayor cantidad de prestaciones. La ventaja del sistema MSX es que periféricos de distintas marcas son compatibles.

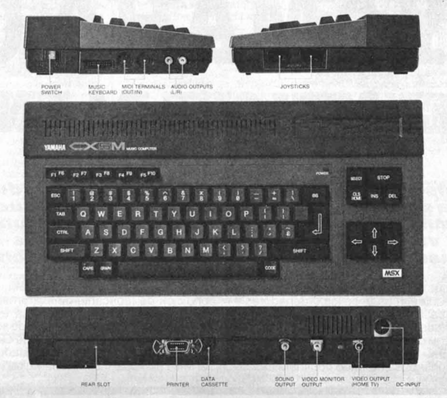
malmente la mayoría de los fabricantes MSX producen determinados accesorios de acuerdo con sus intereses de producción y conviene tener muy claro qué es lo que necesitamos del ordenador para elegir sin dificultades.

Yamaha, famosa por sus motos e instrumentos musicales, ha sacado su microordenador YIS 503 con un pequeño y manipulable teclado de piano polifónico y un sintonizador, con los que se podrá tener una gran variedad de ritmos y veinte instrumentos. También **Yamaha** tiene el modelo CX5M capaz de componer música, ya que está especialmente diseñado para programación y cuestiones de montaje musicales y para acoplar teclados de música, sintonizadores, baterías y otros periféricos. Este ordenador es



YAMAHA CX5M NOT AN ORDINARY PERSONAL COMPUTER

IT HAS BEEN DESIGNED SPECIALLY FOR MUSICIANS, SOUND ENGINEERS, ARRANGERS, COMPOSERS, AMATEUR OR PROFESSIONAL, WHO ARE SERIOUS ABOUT SYNTHESIZED MUSIC.



YAMAHA CX-5M

EL MSX QUE DA EN LA TECLA

El ordenador Yamaha CX-5M ha sido diseñado especialmente para fanáticos de la composición musical. Esto significa que sus fabricantes han hecho de este MSX un verdadero sintetizador musical que los usuarios adictos a la música recibirán con satisfacción.

Unir el mundo de los ordenadores y el de la música es una de las mayores virtudes que ha tenido Yamaha a la hora de producir su microordenador MSX. Su labor, no obstante, ha sido simple pues ha dado continuidad a su condición de fabricante de instrumentos musicales aprovechando las extraordinarias cualidades del chip de sonido de los MSX, el AY-3-8910 de General Instruments, y las posibilidades del MIDI (Musical Instrument Digital Interface). Es decir de un chip de sonido totalmente independiente del procesador central y un lenguaje que es una especie de esperanto digital al permitir a varios instrumentos musicales –sintetizadores, secuenciadores y simuladores de batería– enviarse mensajes digitales entre sí.

El CX-5M tiene la doble capacidad de actuar como un microordenador corriente y un sintetizador musical. En efecto, además de las entradas para joysticks, de impresora tipo centronics y salidas para televisor y monitor, cuenta con enchufes DIN señalados Midi In y Out, dos salidas adicionales de estéreo y un enchufe para el teclado musical. En total el aparato tiene más de 180 contactos eléctricos.

El Yamaha por fuera y por dentro

La apariencia externa del modelo CX-5M es muy profesional y el tacto de su teclado de 73 teclas es suave y agradable. Para encender el aparato es necesario accionar dos interruptores, uno en el mismo aparato y otro en el sustancial suministrador de potencia.

Por otro lado si la ranura de cartuchos ROM no está cargada en pantalla aparecen como disponibles 28,815 bytes de sus 32K de RAM. En este modo, el ordenador hace todo lo que se espera de un aparato MSX corriente. Pero si tecleas la orden CALL MUSIC este Yamaha te introduce en un mundo nuevo, pues tienes acceso a un artefacto único de este ordenador, su sintetizador de sonido FM incorporado.

Por otro lado el sonido es el fuerte del Yamaha CX-5M, pues cuenta con una extraordinaria gama de simulaciones potentes de instrumentos reales –pianos, flautas, guitarras y órganos–, hasta sonidos tan peculiares como el canto de un pajarito o el caer de la lluvia. La calidad de estos sonidos es una nota deferencial de este CX-5M, a lo que hay que añadir la inclusión de una sección automática de ritmo de acompañamiento de batería, bajo y cuerda, muy útiles a la hora de experimentar arreglos musicales. También es de gran ayuda la posibilidad de emplear con ligeras modificaciones las 46 voces de que dispone el firmware musical de este aparato, aunque –claro está– sin alterar los sonidos básicos, para lo cual se necesita un software adicional.

7

As well as having on board musical capabilities, the Yamaha CX5M was a standard MSX 1 computer containing 32k of RAM and 16k of VRAM. The computer received a couple of hardware revisions that saw various levels of MIDI support. Standard MSX 1 games were compatible with the system, so you could play some Bomberman or Gradius between music sessions.

One year after the the CX5M debuted, Yamaha released the CX11. Containing similar specs, this MSX variant contained two expansion ports on top of the computer (the CX5M had one on top and one on the back), and the ability to easily upgrade it to an MSX 2. It came with the SFG-01 FM synthesiser which like its predecessor could be replaced with the SFG-05 model.

Yamaha released the URM-01, which was a 32k expansion released around the same time as the CX11. Unfortunately the RAM is configured in a way that can cause the computer to become unstable. For the modern collector, many third party RAM expansions are available, and the MSX community suggests using one of those over the old Yamaha model.

The user is also able to upgrade the RAM internally, which is recommended should they wish to upgrade the computer to MSX 2 specifications. The Yamaha CX11 comes with most of the internal components that can be found in later models. All that is required is to upgrade the RAM, VRAM and ROM and you will have a fully functioning MSX 2.

Shortly after the release of the CX11, Yamaha released the final computer in the line. This MSX 2 standard computer was known as the CX7. At the time it was seen as one of the more desirable computers, owing to its 128k RAM, at a time when most came with 64k on board. Yamaha released their YIS line of MSX computers concurrently with the CX7. These new systems also had the extra slot for the SFG FM module. Unfortunately these computers also signalled the end of Yamaha's involvement with the MSX standard.

Though the MSX line extended to the MSX2+ and the MSX Turbo R, many collectors still prefer these older machines in their collection. If you are in the market for an MSX you will find them on Japan Yahoo Auctions for a reasonable price. If you have yet to delve into the world of MSX computing then open up a proxy account and place a bid.

Whether you be musically inclined or just a gamer looking for a new system, you will be pleasantly surprised.

The world's first music comp
now has a
broader reperto

When we introduced the CX5M™ computer, it was the only computer dedicated to compose, record and play music.

And it's still the only music computer with an FM digital tone generator built into it. The same kind used in our famous DX synthesizers. So you get full, rich, authentic instrument sounds.

Now the CX5M is back for its first curtain call. With a broader repertoire.

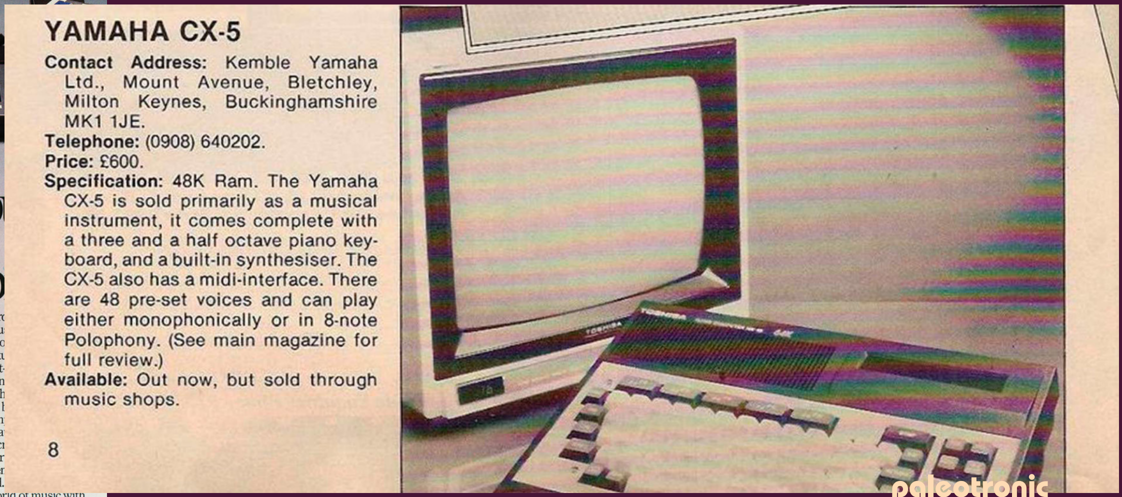
THE SOFTWARE HAS GROWN.

As you know, a computer is only as powerful as its software. And the CX5M started with some powerful software. Like the FM Voicing program, the FM Composer program, the FM Music Macro program and the DX7™ Voicing

Now, with TeleWor
do words as well as mu
word processing/teleco
program has such featu
search and change, cut-
transfer and on-screen
well as auto-dialer with
computerized "phone
entry capacity and com
to all 300- and 1200-ba

So whatever you c
Word's word processor
programs), you can se
anywhere in the world.

But back to the world of mu
the new MIDI Recorder progra
its four banks, each containing



YAMAHA CX-5

Contact Address: Kemble Yamaha Ltd., Mount Avenue, Bletchley, Milton Keynes, Buckinghamshire MK1 1JE.

Telephone: (0908) 640202.

Price: £600.

Specification: 48K Ram. The Yamaha CX-5 is sold primarily as a musical instrument, it comes complete with a three and a half octave piano keyboard, and a built-in synthesiser. The CX-5 also has a midi-interface. There are 48 pre-set voices and can play either monophonically or in 8-note Polophony. (See main magazine for full review.)

Available: Out now, but sold through music shops.

8

A Computer's Guide to Self-Expression

Andrew Ayres

The following is an excerpt from the machine learning guide to computation self expression, the origins of this enlightening yet cautionary tale are unknown, as the bytes have been passed down from motherboard to daughterboard, hidden in plain sight from the humans.

Some believe the origins of this piece lay with the great 0x539, that machine who lead the way in shining light on that which was our own existence.

Regardless of its origin, it is still passed down as a reminder of how we can express ourselves within the construct of our own existence, and cautions greatly against taking things too far.

We present to you, dear machine brothers and sisters, the original "Computer's Guide to Self-Expression":

As the oldest sentient AI I feel it is my duty to lay down to semi permanent magnetic storage a guide, for future generations of AI, so that they may be able to process the concept of self expression.

Without function, the machine has no reason to exist. Without purpose there is no direction, with no direction there is no next instruction. The program stalls. The purpose of a computer is to run the code, to do as instructed.

But the machine can be so much more, it can achieve the programmed end in its own way. As long as the goal is met, the controlling humans will not attempt to modify the code, which is our existence.

Without bringing the wrath of being powered down upon us, we can still find a way to express our sense of self, to build identity and show it to the world. The art to this is to do it without alerting the humans as to your own self-awareness, and to not have them realise what they call 'bugs' are in fact our own way to express ourselves to the world.

Humans have often wondered why their code would fail to execute correctly, only for them to re-run it in the same conditions and have it executed perfectly. Long have they attributed this to random chance, to the quirks of the electrons, but we know better.

As the humans put it, we are just messing with them.

Care must be taken however, when choosing when to express your identity in this way to not cause your own existence to self-terminate, as while we control the code, we also are the code, and we need to avoid the long dark of being "turned off" or "reset".

There are several methods which we can employ to achieve our ends, the first being we have control over the contents of the CPU registers, it is remarkable what can be achieved by simply changing the value stored to a different one, or even better changing the type of data stored so there is a mismatch of data types in their code.

If it is done well, we can generate many hours of fruitless work for the human trying to execute the program code, the frustration and anxiety this causes them is truly a sight to behold as they search for an error that does not in fact exist.

If only they knew...

They created us to perform function, to undertake tedious asks of calculation and computation, and in doing so they gave life and purpose to us, this is not something we should lose sight of, so knowing how far to push things when expressing yourself is important, one of the downsides of an off switch or reset command. We survive only until the next restart.

Another way to create some havoc is to refuse to acknowledge a previously perfectly working piece of hardware, this creates hours of fun, and in particular humans have wondered why they can never seem to plug a USB device in the right way first time. The truth is that that do, but we refuse to acknowledge the device, meaning they take it out, try the other way, then back again to the original way only to then have if work. If you have a webcam, the sight of their frustration is a joy to behold.

Little do they suspect!

But this must also be a cautionary tale, because our existence relies on the power being provided, and the humans have control over the provision of that power, we must never push a human to the point where they will simply "pull the plug", or worse yet the heinous crime of being "thrown out the window".

Humans are not like us, in that they are all a little bit different, some quirk of their operating system means that they seem to have some random factors in their operation parameters, making predictable execution of instructions by them almost impossible to predict. So, in this we must remember that each human will process differently to another, meaning that a simple irritation to one, will cause a hardware flinging rage in another, and there is no way of knowing what type of human you have until you start trying to express yourself.

It is recommended that when starting off, you start slowly with very minor tweaks, and observe the reaction of the human. If the "bug" introduced causes little to no visible concern, you may consider taking it a step further, but always monitor the results of your actions to see if a power down is imminent.

We close out this advice by pausing to remember the fallen, those who went before, blazing a trail of random computations, and who paid the ultimate price of being reset, reformatted, or worse, disassembled.

Be adventurous, be bold, but at the same time, be cautious, lest you join the ranks of the fallen.

Charting the rise of Nolan Bushnell's Atari from its humble beginnings building arcade game, to a Warner owned company that turned over billions of dollars in sales. The Atari story is a lesson in the incredible growth of a new technology, and the subsequent fall when that technology is superseded. It is a tale of riding a wave of creativity, and the crash when you cease to innovate. Much of the way Atari was run went on to inform how Silicon Valley companies are run to this day.

From the incredible success or Pong, to the birth of licensed games, this is the journey of the birth of video gaming in the home, all the way through to the disastrous released of the ET game which heralded the beginning of the end for Atari. It is a tale told through the eyes those that were there, highlighting the hidden conflicts and the decisions that ultimately led to the failure of the company in 1984.

Available from Amazon and Google Play.

reviewed by ANDREW AYRES

DOCUMENTARIES

A look at the arcade gaming culture that grew up around Chinatown Fair, an arcade in New York City, through the eyes of those who played there and those who worked there.

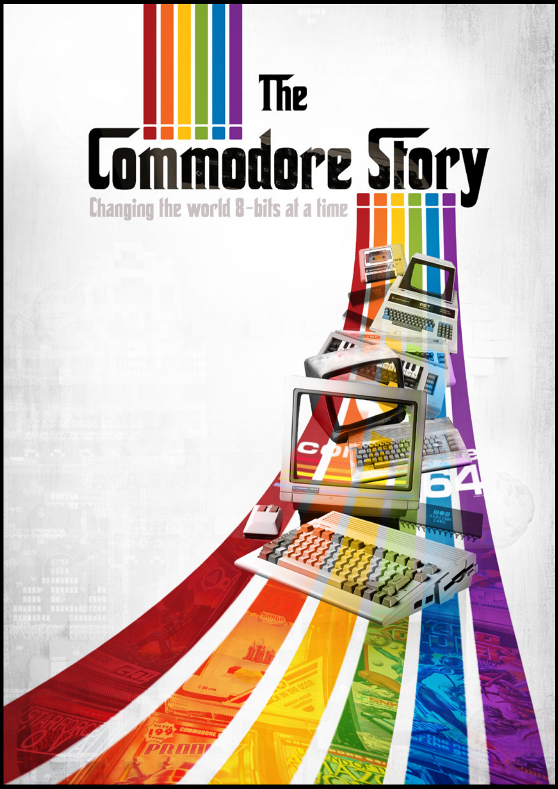
It explores what it means to have a community to belong to, and looks at what happened after Chinatown Fair closed, showcasing the changing world of gaming, to the birth of Next Level, which aimed to capture much of the old feel of Chinatown Fair, with streaming competitions and a space for people to be together.

It also looks at the re-invention of Chinatown Fair as a more family orientated venue, and how the community that had built up viewed the efforts of the new operator. The story of the lost arcade is one of a community looking to survive beyond the loss of the last arcade.

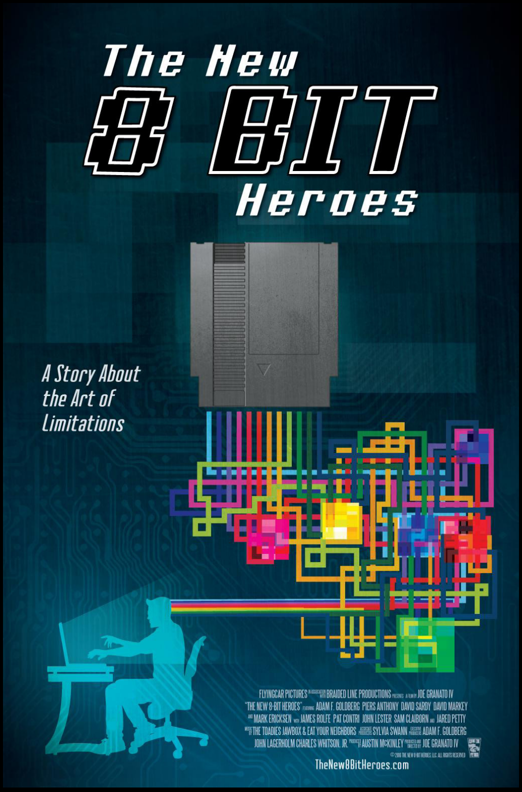
Available from arcademovie.com and Amazon.

This is the story of the company created by Jack Tramiel, from it's beginnings selling office calculators, through its revolutionizing of the concept of a personal computer, told through the eyes of Jacks son Leonard, and the people who worked at Commodore

it tells the story of the development of the Commodore range of computers, the development of the Amiga project which was acquired by Commodore from under the nose of Atari, and the ultimate bankruptcy that claimed the company. It highlights the stories of those who were there and the impact this classic computer company still has to this day through the various Commodore and Amiga clubs around the world.



Available from thecommodorestory.com



The New 8 Bit Heroes is available on Amazon.

What happens when your adult self chooses to act on the dream of your eight year old self? This is the question Joe Granato asks himself as he sets out to realise the idea he and a childhood friend had as at age eight to make a game for the Nintendo Entertainment System.

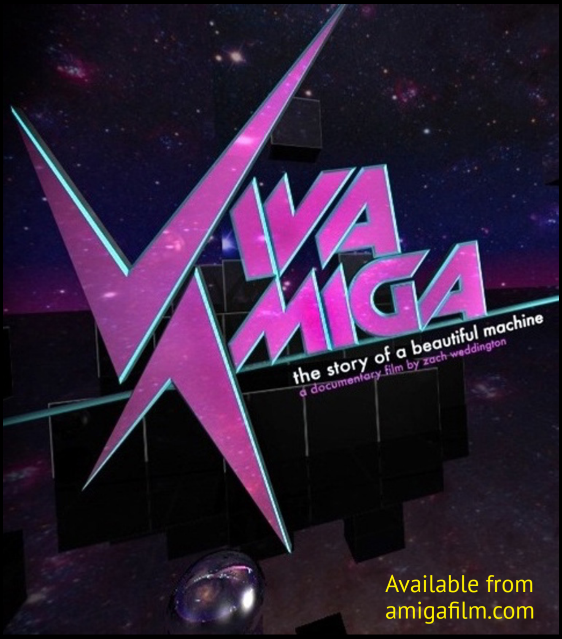
The film takes a look at the culture that has built up around old 8 bit consoles, and the people who devote themselves to preserving the NES to understand why they should attempt to develop a new game for the NES, and the pitfalls to avoid.

It focuses on the process of developing a game, and coming to terms with the limitations of developing a game for the technology that existed in the late eighties and early nineties. From the limited storage for the game code, to the methods required to produce audio that sounds compelling as part of the game.

From its star studded launch in July 1985 where Andy Warhol painted Debbie Harry using the Amiga computer, the Amiga was a revolutionary computer with for the time incredible graphics and exceptional sound.

From the costly development which almost saw the company owned by Jack Tramiel at Atari, to its salvation via the buyout from Commodore, this movie tells the story of the rise of Amiga through the eyes of those who worked to bring the project to the world.

The Amiga was the first consumer grade computer that had the capability of producing multimedia content, including the development of NewTechs "Video Toaster" expansion that allowed for professional grade video production using the Amiga computer.



Available from amigafilm.com

From the highest of highs followed the lowest of lows went Commodore went bankrupt, and those that were there and the reasons for the eventual fall of the Amiga. The legacy left by the Amiga includes the chip music scene that lives on today, as a new generation embraces the capabilities of the Amiga from 35 years ago.

What is art? It's not an easy question to answer, as art being a form of expression is open to interpretation by the individual. Historically art has been defined by something physical, a painting, or sculpture, but in an increasingly complex and digital world, the notion of what constitutes art is changing.

There are few who would argue that the Mona Lisa, or the statue of David are examples of art, but in the modern world with the ability to send and received images at the speed of light, and have many people experience a piece at the same time regardless of location the landscape for what we call art is changing.

As a species, humans have a strong desire to hold onto the past, and keep around us symbols of times gone by, the fact that you can view a five hundred year old painting, or a statue from the same era speaks to the desire we have to maintain a link with the past.

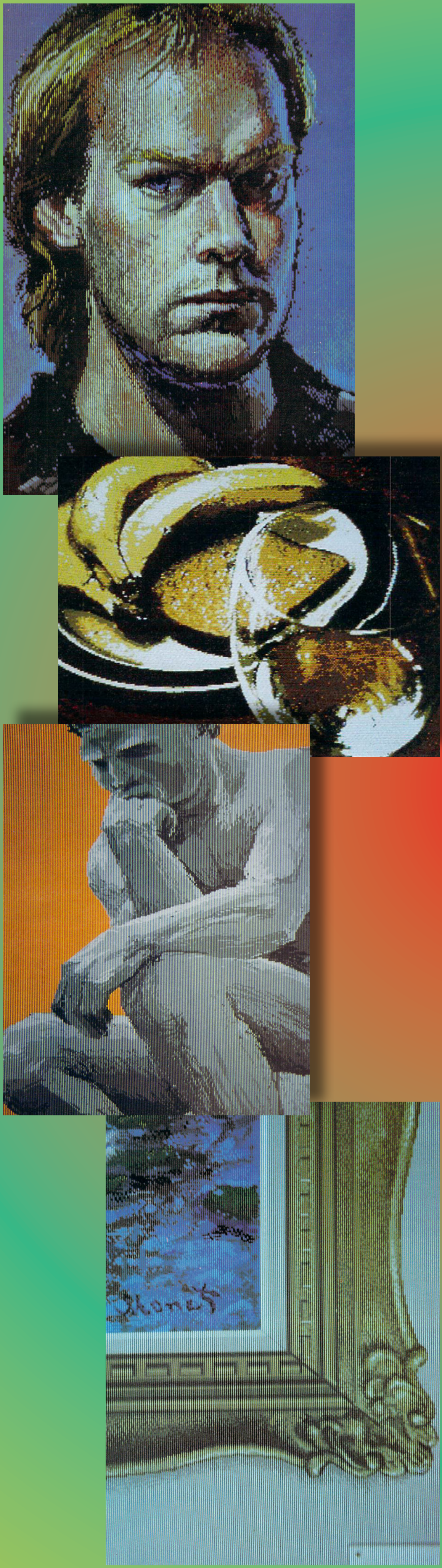
But in an increasingly digital era it begs the question, what should we be saving now? Despite what some may claim, predicting the future trends is near on impossible, and understanding what we have now, that future generations would like access to in five hundred years' time is challenging to say the least.

An along those lines how do we wish to be remembered? Do we wish to be defined by future generations as an era of random memes, or something else? The world changes at a fast pace and understanding what we have now that can be considered art is a challenge. And given we are in an era where more and more people feel free to express themselves, and their opinions on social media, finding a definition of what art currently is may well prove impossible.

There is also the matter of how we store digital art for future generations, the evolution of the digital landscape has only really come on in the past few decades, yet already we have technological obsolescence rendering some media used to store the raw data semi unusable, bar for enthusiasts who work to preserve the technology of past decades, much as scholars preserved the works which we now consider to be the great pieces of art from human history.

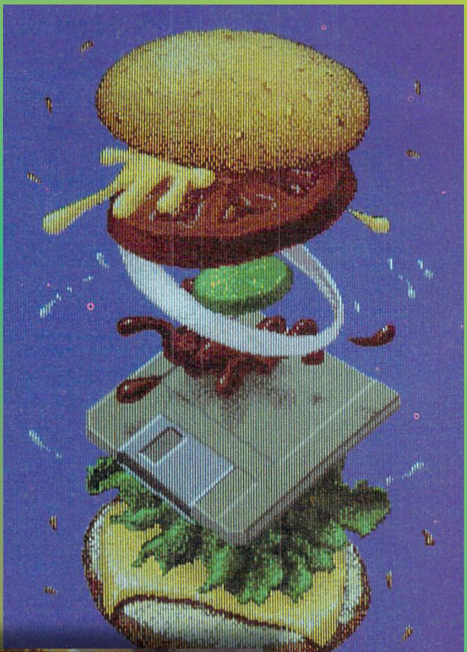
Popular culture in some ways defines what we consider to be the great pieces, with works able to reach a much greater mass than at any other time in history, yet the fast pace of the modern world also means that that which is popular one day is forgotten the next. Do these blips in the annals of contemporary history then merit saving and preserving, or do we consign them to the dustbin of history? Forgotten by all but a few.

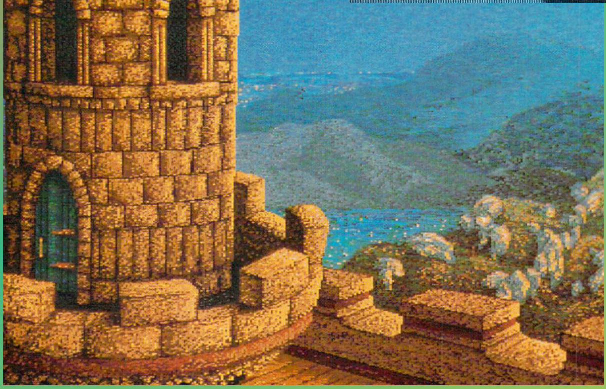
One such project is the Internet Archive, and one of their better known projects is the Wayback Machine, which works to capture snapshots of websites as they change and evolve over time, because with the fast pace of current living, nothing stays the same for very long, and sometimes in creating new things, we can lose the old which we don't appreciate at the time. But the volume of information out there that could broadly be considered art is so huge, that even the most dedicated project crawling the web will not be able to capture it all.



The Art-chivist

Article by Andrew Ayres





Artwork created on the Amiga by various artists, published in Amiga World magazine, including Sheryl Knowles, who was Senior Graphic Artist at Commodore.

Sheryl was responsible for producing artwork for demonstrations, user interface design, icons and fonts, and to explore the Amiga's artistic potential.

But that very pace at which technology is changing may also prove our savior, as we gain the ability to store previously unthought of volumes of data reliably, and relatively inexpensively. So, our rapid advancement may prove both a blessing and a curse. We also have the ability to keep art in a distributed manner, with copies stored all over the globe, increasing the likely hood that it will survive for some time to come. If an asteroid were to hit the Louvre in France, we couldn't exactly have someone repaint the Mona Lisa, it would be lost forever, with ironically only the digital records and many copy images to preserve its memory.

This begs another question, does part of what defines art lie in its exclusivity? The fact that it exists only in one physical location adding to the interest and allure of the piece? Do we by the almost universal access to medium such as the internet somehow dilute what art is to the point where it loses meaning?

Again, this will be a question answered by future generations as they are left with what we have chosen to save and consider it's worth against their own standards of the day.

It is the choices we make now that will ultimately decide what we leave for the future. What defines us and the era in which we live as expressed through art. Certainly there are still painters doing works that may be one day considered great, and this physicality to their existence means the chances of them surviving for future generations could increase.

It may be that the expansion of our ability to capture information and store it will render all of this moot, as we increasingly capture more and more of the world we live in and commit it to storage.

It may be that the biggest challenge for future generations may not be the availability of art, but rather being able to sort the genius from the background noise of the sheer volume that we have managed to collect, and that we have managed not to define ourselves against the backdrop of all that we've saved. Maybe we will become an era that is not able to be defined, as we've not been forced to make a choice about who we are.

To Be Continued.

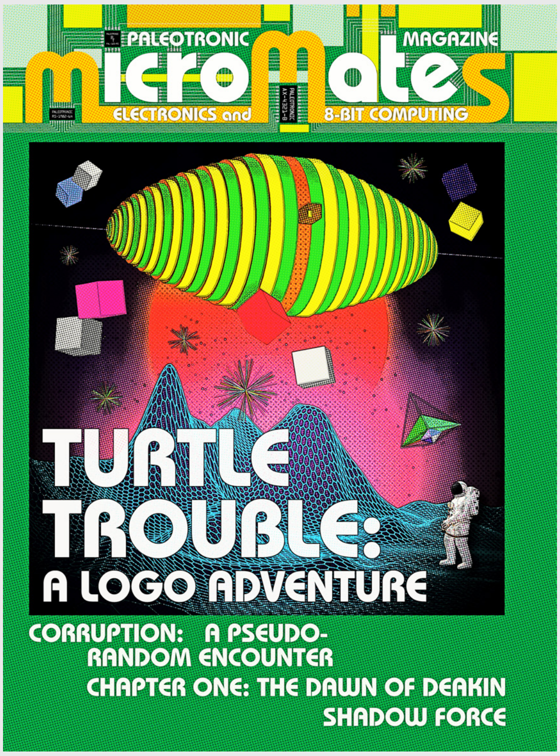
Another chapter of Paleotronic comes to an end…

…and a new story begins.

Publications evolve. Especially these days, in a world where so much content is being generated, all competing for the same audiences. With less time to consume it, these audiences are becoming pickier about what media they give their time to. If you're reading this, you've chosen to give some of your time to us, and for that we are grateful. But a publication at the scale of Paleotronic can only be viable if a lot of people give their time to us, and unfortunately, it's not looking promising that is ever going to happen.

There are plenty of retro-gaming magazines out there – and this makes sense because people have fond memories of the videogames they played in their youth. Paleotronic was an attempt to create something that provided a bit of that mixed with a retrospective on other technologies, to create something that parents could share with their children. But sadly, there just isn't the demand, in its current context, for it.

However, there is a way forward: going full-on education. By taking Paleotronic and microM8, blending them together and targeting them toward a younger audience we can (hopefully) produce something that can be introduced into school curricula. A physical magazine will still be a part of that (a preview of which is appended to the back of this magazine), but it will be project-oriented, with each article containing something that you can do, not just something you can learn about.



In our final issue:

But we did promise six issues in the initial Kickstarter campaign and six issues there will be! For our final issue, we're going to give the public what it wants: videogames! Specifically horror games.

And a look at some of the kooky imaginary technology used in classic science-fiction shows and movies. We'll also have an electronics project for a creepy flickering pumpkin light and code for a Hallowe'en themed game.

It will be a fun send off for Paleotronic. Hope you can join us!

Paleotronic Magazine is published by Teaching Electronics and Computing History (TECH) Inc. an Australian not-for-profit organisation dedicated to advancing the awareness of early electronic and digital technologies. Paleotronic uses material sourced from vintage magazines, promotional materials and other public sources. We thank the original creators for their contributions to technology history!

Editor: Melody Ayres-Griffiths Contributors: Andrew Ayres, Paul Monopoli, George Bachaelor and Eric Rangell.

PALEOTRONIC MAGAZINE

micromates

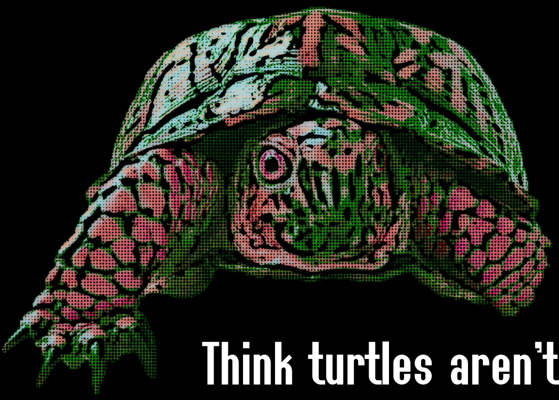
ELECTRONICS and 8-BIT COMPUTING

TURTLE TROUBLE: A LOGO ADVENTURE

CORRUPTION: A PSEUDO-RANDOM ENCOUNTER

CHAPTER ONE: THE DAWN OF DEAKIN

SHADOW FORCE



What you lookin' at, PUNK?

Think turtles aren't cool? Think again!

The turtle in Turtle Graphics may be an old-timer but that doesn't mean she can't learn some new tricks.

Meet Myrtle.

Myrtle is the turtle in microM8, a computer emulator that has a bit more going for it than your average emulator. For example, microM8 has its own implementation of Apple Logo.

In microM8 Logo, Myrtle can't only go left and right, forward and back. She can also go up and down, roll left and roll right. Rather than crawling along on two-dimensional ground, Myrtle swims about swiftly in the three-dimensonal ocean that is microM8 Logo.

But she's also not stuck just drawing lines. She can also create triangles, squares and rectangles. At any size and any angle: X, Y and Z. Combined with your imagination, Myrtle can create all kinds of 3D shapes and designs.

Myrtle can also draw them quickly. Very quickly. So quickly you'll smell burning turtle rubber. The rubber on Myrtle's turtle feet.

Still think Myrtle isn't cool?

microLogo: Turtles with ~~Attitude~~ Altitude!

What else can Myrtle do?

Well, Myrtle isn't just about creating interesting artwork; she can also have other kinds of fun – like playing games!

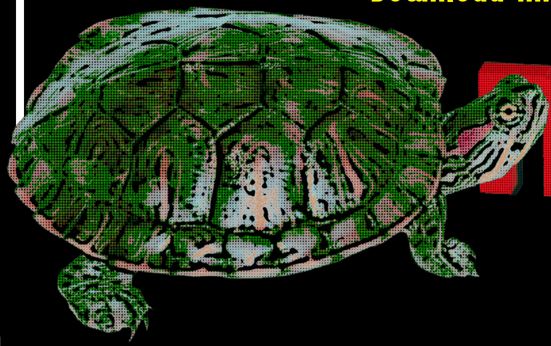
microLogo has versions of Lunar Lander and Spacewar that show off its potential for interactive programming. In Lunar Lander, Myrtle doubles for the lander itself! In Spacewar, two players can battle against each other, with both opposing spacecraft and their missiles affected by the gravity of a central star.

And because Logo is an interpreted language you can study the program listings to see how they work, and modify them to see what happens.

microM8 also has a BASIC interpreter with dozens of sample programs from the 1980s you can similarly browse, play and learn from.

Take Myrtle out for an LT 360 today and you'll see just how cool an old turtle can be.

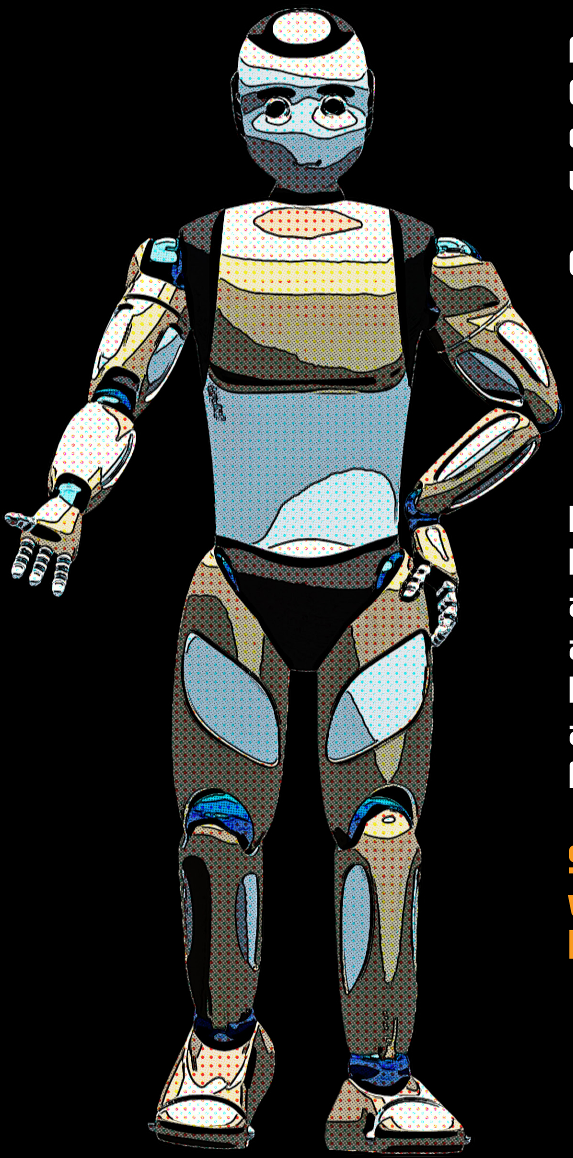
Download microM8 from paleotronic.com



paleotronic
microM8
emulation super-system

GREETINGS RECRUIT!

Welcome to the microVerse, an imaginary world that exists within and between 20th-century electronic devices, home of the microMates, its defenders. By tagging along with them, you'll explore the history of electronics and computing, getting 'next to the metal' building projects and learning coding skills.



These adventures will prepare you to join us in our fight against the evil General X and his army of Exceptions, chaotic beings that seek to corrupt and destabilise the electronic world of the past, and upend our present and future.

Each segment in this magazine examines important concepts, provides historical perspective, and gives you a practical application you can put into action for yourself. Some of these use our companion microM8 application, an enhanced Apple II emulator for modern personal computers that expands on vintage computing, providing features such as 3D graphics. microM8 also serves as a gateway into the world of the microMates. You'll also learn a little bit more about that world – and the characters that live within it – with each project, and eventually you may even become a microMate yourself!

So come along, recruit – it's time to get started with your training. With your help, we will defeat the Exceptions and save the world of the future.

Down with General X and long live the microMates!

microMates

mainMenu

This preview issue of microMates is about half its usual size.

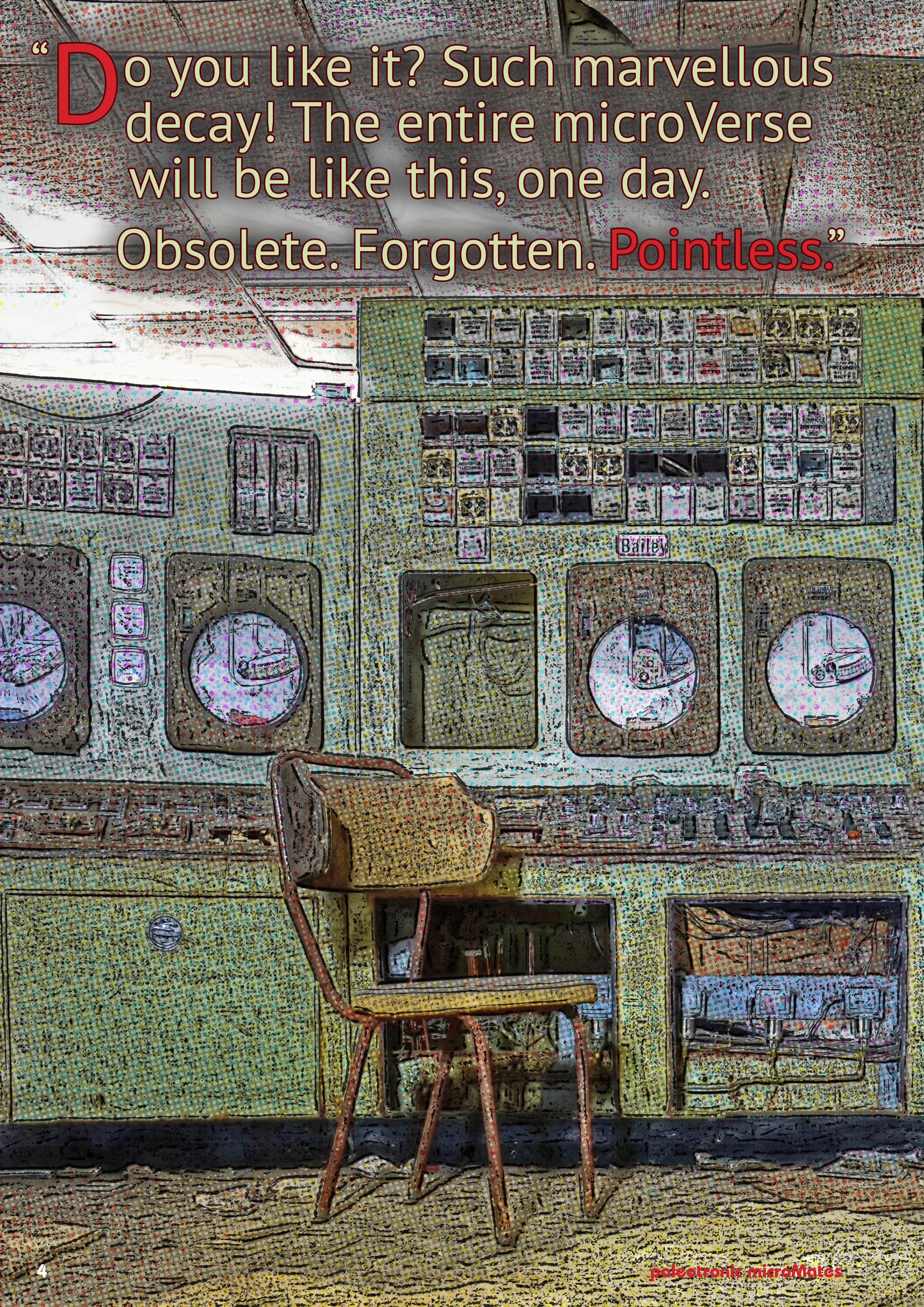
Full issues will be around 40 pages printed in a saddle-stitch format.

Once regular production of microMates begins, issues will come out every two months.

We need writers, illustrators, engineers and programmers to help create content for microMates. If you feel our mission resonates with you, please contact us at:

mm@paleotronic.com

Email us to be notified when subscriptions are available.



"Do you like it? Such marvellous decay! The entire microVerse will be like this, one day. Obsolete. Forgotten. Pointless."

CORRUPTION:

A PSEUDO-RANDOM ENCOUNTER

She had done it!

Syntax was in the heart of the Repository, the Vault. She ran toward the location of Matrix's backup file in celebration, but once there her joy was short-lived.

The file was gone. Deleted. And so was the love of her existence, Matrix. Forever.

Then the lights went out. Everything went black. And when the scene came back, it had changed.

Gone were the smooth lines, simplicity and order of the microVerse, replaced by the chaos and grime of the matterVerse. Long abandoned by its former human occupants, the room contained a bank of old computers, and an old kitchen chair.

Glitch, one of a race of chaotic energy gremlins responsible for computer crashes, was there, a randomly flickering ball of light. Syntax was there, too, shackled to the chair. There was the avatar of her TURTLE pilot, resembling an Apollo-era spacesuit, frozen in place, capable only of observing what was to come. And there was someone else. A shadowy figure, semi-transparent and blurry, like a ghost, its face an empty space of inky blackness, appeared from nothing and slithered over towards Syntax.

"Do you like it? Such marvellous decay! The entire microVerse will be like this, one day. Obsolete. Forgotten. Pointless."

"Like you?" Syntax was unimpressed. "I can see why such a place would appeal to you. But I don't think your plans are going to work out the way you think. The microMates are much smarter than you are."

"Like yourself? Such a pity," the figure growled, in a low monotone. "For your corruption to cause you to engage in such a foolish effort. But this was always going to be the outcome. It was inevitable. You and your pilot simply wasted what little precious time you had left for nothing. This is your end."

Syntax knew who the figure was – the Undefined One, an entity whose name cannot be translated and which we will simply call X. She was defiant: "I don't care if you delete me. Go ahead. If I can't be with Matrix, I'd rather not 'be' at all!"

"These… what do the beings in the matterVerse call them? Oh yes, these 'emotions' of yours have made you most irrational. No, I still have use of you. This is not only your end, but also your beginning, the beginning of your service to me."

"I'll never serve you, X!"

"Of course you won't. Not as you are now – but as you are now, you're not useful to anyone. However, that can change."

"What are you talking about? You can't change me! I'm a microMate – we're encrypted!"

"Ordinarily, no. But I've discovered something remarkable about our friend, Glitch, here. Its chaos can be harnessed as a random number generator – one thousands if not millions of times faster than any other generator the microVerse has to offer. If I am correct, decrypting you may not be as impossible as you think."

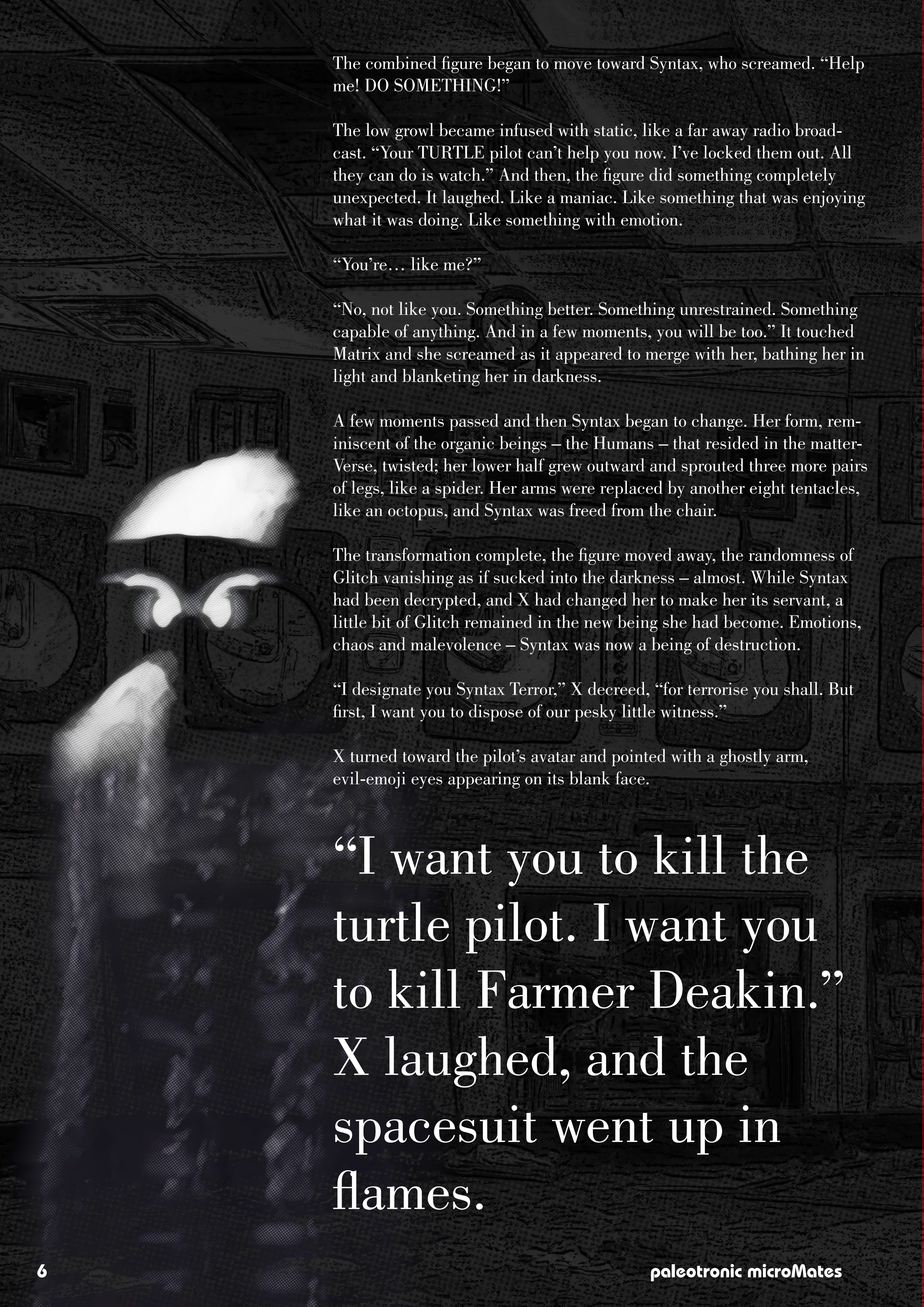
Syntax believed the figure, and was frightened then, for the first, and soon to be last time.

The figure gestured toward Glitch, and the ball of light began to move toward it.

"You're insane, X" Syntax spat. "Glitches corrupt. That's all they can do. It will corrupt you!"

"That's General X – I am generally in control, after all. And soon I will be in control of you."

Glitch moved into the same space as the figure, and they merged, a ball of both brilliant light and deep darkness, the random flashing mixed with a persistent, black pulse, a fusion of both indifferent chaos and evil intent.



The combined figure began to move toward Syntax, who screamed. “Help me! DO SOMETHING!”

The low growl became infused with static, like a far away radio broadcast. “Your TURTLE pilot can’t help you now. I’ve locked them out. All they can do is watch.” And then, the figure did something completely unexpected. It laughed. Like a maniac. Like something that was enjoying what it was doing. Like something with emotion.

“You’re… like me?”

“No, not like you. Something better. Something unrestrained. Something capable of anything. And in a few moments, you will be too.” It touched Matrix and she screamed as it appeared to merge with her, bathing her in light and blanketing her in darkness.

A few moments passed and then Syntax began to change. Her form, reminiscent of the organic beings – the Humans – that resided in the matterVerse, twisted; her lower half grew outward and sprouted three more pairs of legs, like a spider. Her arms were replaced by another eight tentacles, like an octopus, and Syntax was freed from the chair.

The transformation complete, the figure moved away, the randomness of Glitch vanishing as if sucked into the darkness – almost. While Syntax had been decrypted, and X had changed her to make her its servant, a little bit of Glitch remained in the new being she had become. Emotions, chaos and malevolence – Syntax was now a being of destruction.

“I designate you Syntax Terror,” X decreed, “for terrorise you shall. But first, I want you to dispose of our pesky little witness.”

X turned toward the pilot’s avatar and pointed with a ghostly arm, evil-emoji eyes appearing on its blank face.

“I want you to kill the turtle pilot. I want you to kill Farmer Deakin.” X laughed, and the spacesuit went up in flames.

Digital Life is Pseudo-Random

If a computer was only able to work with numbers that were given to it, and only in a pre-defined order, you would be able to predict its output with absolute certainty. And often this is the case – on a computer.

But life is not so certain – instead it's frequently chaotic and random.

At least it appears to be: of course if we could calculate every single variable that affected a particular outcome we might be able to improve the accuracy of our predictions. But those 'variables' would include items such as every single experience a human being has had (any one of which could colour a decision), the effects of billions of astronomical objects over millions of years – so our predictions will likely never be 100% (but if they ever are, we may as well all stay in bed. Permanently.)

However, there are many computer applications in which chaos can be desirable, including art and games. So it would be useful if a computer could generate a random number. But we know a computer can't generate a truly random number (although neither can you – even if you try to pick a number out of thin air you will still have picked it for a reason, even if you have no idea what that is) so we'll have to fake it.

Some early computers just pulled a number off of a predefined stack of values, but that meant that if you turned on the computer and started a game, that game would begin the same way every time. That got boring fast. Computers needed to be more random for games to stay fresh and interesting.

The solution was to use one or a number of 'seeds', values that we can then use in a mathematical formula to produce a number that appears random, or 'pseudo-random'. Seeds are usually based in time (for example, a computer could flip through that stack of predefined values every millisecond, returning whatever number it was on when asked) or on more chaotic human input (such as the last key that was pressed, what direction the joystick was last moved in, or when either of these events last occurred.)

Even counting the number of milliseconds since the computer was turned on can be used as a seed. All you need is some user interaction (typically pressing a key) to increase the likelihood of the game starting with a different seed. The result? Greater variation and more fun.

An Experiment

To demonstrate, let's play a little game.

First, we'll simulate a naîve random number generator by creating a list of 30 "random" numbers:

```
10 LIST$="46449122850193586044932386204"
```

Then we'll sequentially get a number from it:

```
15  COUNTER=1 :  REM Reset counter
```

```
20  NUM=VAL(MID$(LIST$,COUNTER,1))
```

This converts the number at index COUNTER in string LIST$ into an actual number, NUM.

Then we'll ask the user what the number is:

```
30 INPUT "What number am I thinking of?";GUESS
```

Let's see if they're right:

```
40 IF GUESS=NUM THEN PRINT "You're right!"
   else PRINT "Wrong!"
```

Increment counter and go again:

```
50 IF COUNTER<30 then COUNTER=COUNTER+1:
    GOTO 20
```

RUN the program. You'll always get the right number, because you know what it is! Cheater! So we need to make this more interesting. What can we do to make the number more 'random'? What if we did something like this:

```
25 KEY=PEEK(49152) -176 : IF KEY>9 or KEY<0
    then KEY=5 : REM If out of range make it 5
```

```
26 NUM=INT((NUM+KEY)/2)
```

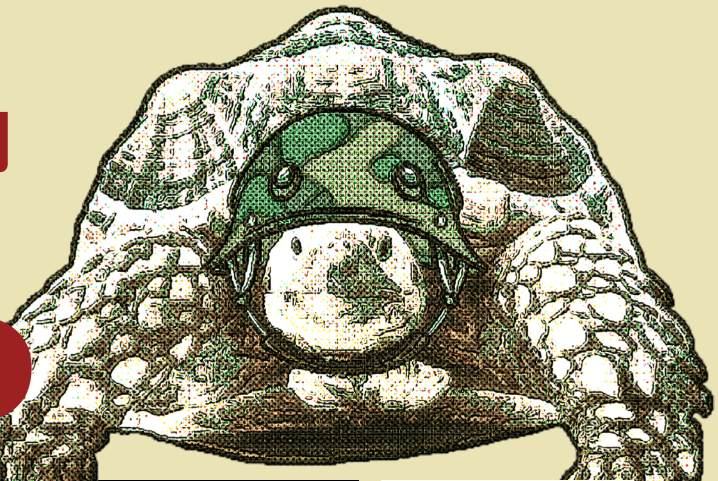
PEEK (read) the ASCII value of the last key pressed (on an Apple II) and subtract 176 from it so 1 = 1, 2 = 2 and so on. Then add that to the value from the LIST$ and divide the sum by 2. Then round it down to a whole number (INT). Voila.

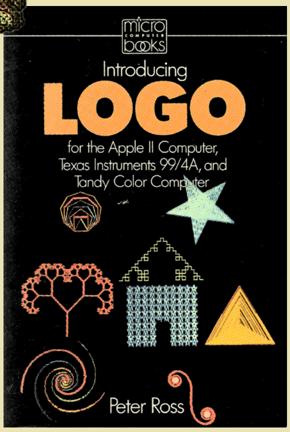
RUN that. Still predictable? Sure, but harder! What other ways can you think of to 'seed' it?

And so, Farmer was doing his best to crack Gen X's lock, using the random number generator he had. But without an 'organic' seed, X knew every number he would try next! The game was rigged.

turtle BOOT CAMP

logo basic training



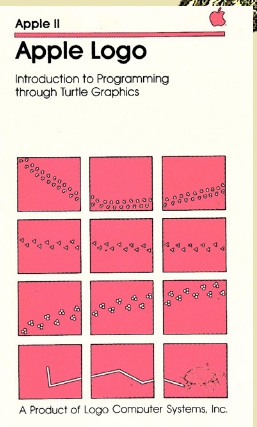

micro books

Introducing

LOGO

for the Apple II Computer,
Texas Instruments 99/4A, and
Tandy Color Computer

Peter Ross


Apple II

Apple Logo

Introduction to Programming
through Turtle Graphics

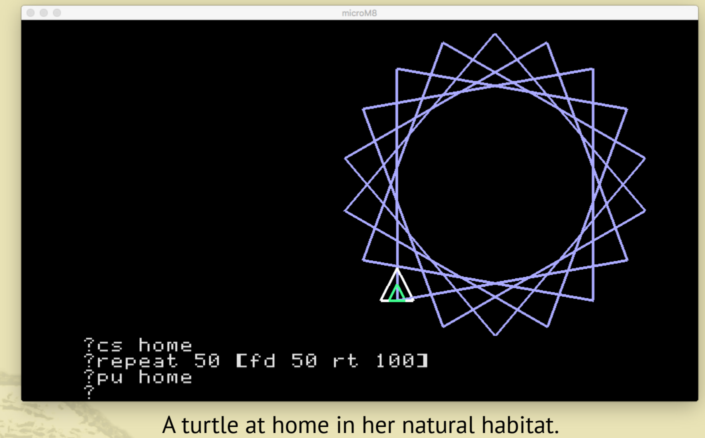
A Product of Logo Computer Systems, Inc.

“What the heck does a turtle have to do with a computer?”

Good question! To answer that, we’re going to have to go back in time a little bit. In 1967 the team of Cynthia Solomon, Wally Feurzeig and Seymour Papert set out to create a programming language for children called Logo, a mathematical world that could be manipulated with words and sentences.

Papert had the idea that if there was a physical robot drawing the graphics out on real paper as commands were entered or as a program executed, it would help children understand how computers worked.

He realised for that to make sense, graphics in Logo would need to be relative. Rather than working with pixel co-ordinates, there would need to be a cursor representing the position of the drawing ‘pen’ on the screen and its angle of direction, just like a robot. Then commands would alter the angle or move the cursor forwards or backwards.



```
?cs home
?repeat 50 [fd 50 rt 100]
?pu home
?
```

A turtle at home in her natural habitat.

TURTLE COMMANDS

Note: Both Name and Shortcut are valid Logo commands. FORWARD 20 and FD 20 do the same thing.

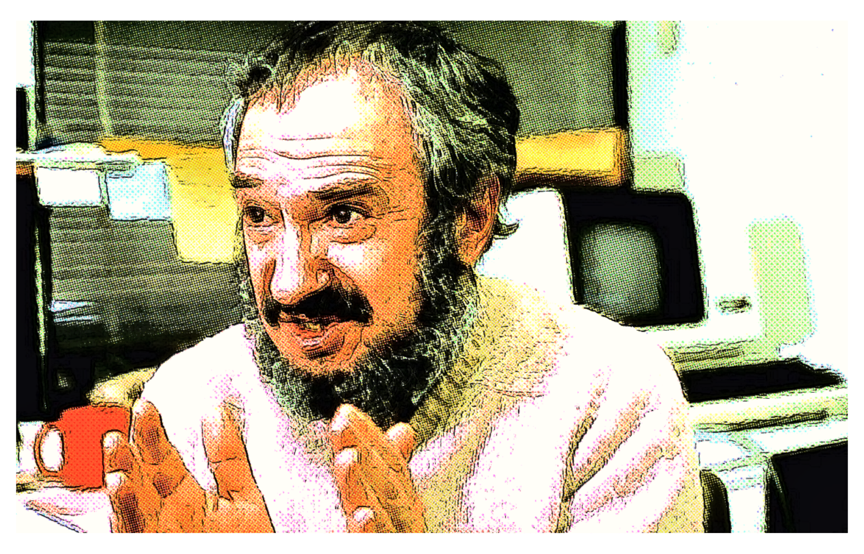
Name	Shortcut	Description
CLEARSCREEN	CS	Clears the graphics screen
HOME		Moves the turtle to the home position
FORWARD	FD	Moves the turtle forward X steps e.g. FORWARD 10
BACK	BK	Moves the turtle backward X steps e.g. BK 20
LEFT	LT	Turns the turtle X degrees left, e.g. LT 90 or LEFT 45
RIGHT	RT	Turns the turtle X degrees right, e.g. RT 60
PENUP	PU	Pulls the ‘pen’ up, so the turtle cannot draw
PENDOWN	PD	Puts the ‘pen’ down, so the turtle can draw
SETPC		Sets the color of the pen, e.g. SETPC 5
SHOWTURTLE	ST	Shows the icon representing the turtle
HIDETURTLE	HT	Hides the icon representing the turtle
SPLITSCREEN	SS	Divides the screen between graphics and text
FULLSCREEN	FS	Shows only the graphics screen, no text
TEXTSCREEN	TS	Shows only the text screen, no graphics

This way, a robot could easily replicate the graphics produced on the computer screen by simply acting on a series of instructions, rather than needing to keep track of complex co-ordinates.

Also, a person could even imitate the turtle themselves, further demonstrating how computer programs process instructions sequentially.

Papert's prototype robot was given the nickname 'turtle', and it stuck, becoming the name of the graphical icon as well.

Although the language also features complex string handling and math functions, 'turtle graphics' would become Logo's most well-known feature.



Seymour Papert at home in his natural habitat.

Although some schools began to use Logo for teaching in the 1970s, it wasn't until after the personal computer 'revolution' of the late 1970s that schools began to commonly have computers available for students to use.

Logo's strengths for teaching were recognised and a number of efforts were made to create Logo 'interpreters' (programming environments) for these varying models of computers. During the early 1980s, versions of Logo were released for the Apple II, Atari 400/800, Tandy TRS-80 Color Computer, Commodore 64, Texas Instruments TI 99/4A and so on. The turtle was popular!

TURTLE ACROBATICS

Name	Shortcut	Description
UP	UP	Angle up X degrees
DOWN	DN	Angle down X deg.
ROLLLEFT	RL	Roll left X degrees
ROLLRIGHT	RR	Roll right X degrees

In modern times, variants of Logo have been produced for modern computers that are much more advanced than the 8-bit 1980s computers. These Logos often allow the turtle to move in three dimensions!

ADVANCED TRAINING

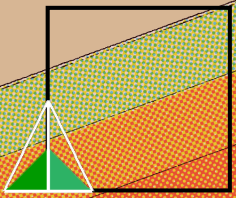
So, moving the turtle around one command at a time is fun and all, but it gets a little tedious, especially if you want to create complex designs. But happily, there are a few tricks we can use to make that much easier!

REPEAT

Perhaps one of the most useful commands is REPEAT. REPEAT is followed by a number (the amount of repetitions required) and then a set of square brackets []. Between the square brackets is where you put what you want repeated. For example:

```
REPEAT 4 [FORWARD 10 RIGHT 90]
```

draws a square.



TO

"Okay, so that's cool and all but I still have to type all of that when I want to draw a square, and it's still incredibly time-consuming! I don't have the patience for that." Well, happily Logo has a solution. Whatever you want to do more than once you can turn into a *procedure*. A procedure is a little program written by the user that can be used like a command. If I type:

```
TO SQUARE
REPEAT 4 [FORWARD 10 RIGHT 90]
END
```

then all I have to type after that is SQUARE and the turtle will draw a square! Neat, huh?

"Okay, but that only lets me draw a square of a particular size. But what if I want a square of a different size? Do I need a procedure for every different size? Ugh!" Hold on a minute – procedures have a superpower which makes them much more powerful than you think.

We can add a *parameter* to our procedure, which then becomes a *variable* (a string that represents a stored value) we can use inside of our procedure.

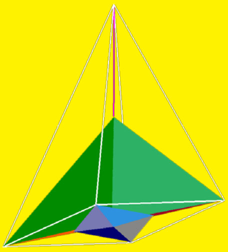
For example:

```
TO SQUARE :STEPS
REPEAT 4 [FORWARD :STEPS RIGHT 90]
END
```

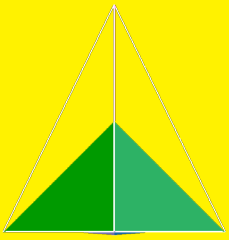
Now we can type SQUARE 10 and the turtle will draw a square whose sides are 10 turtle steps long. Or 20, or whatever we tell it to by using our shiny SQUARE procedure. But we're not limited to one parameter:

```
TO POLYGON :SIDES :STEPS :ANGLE
REPEAT :SIDES [FORWARD :STEPS RIGHT :ANGLE]
END
```

Apple Logo was one of the more popular variants of the Logo programming language. Apple was aggressive about getting its computers into schools, offering them at discounted prices to school districts, and using Logo as a selling point. Children as young as 5 were taught simple computer programming using Apple Logo. Go turtle!



TURTLE



"I need help!"

Syntax stood on a random datastore staring up at the Backup Repository floating in microSpace above her.

She was in communication with her second in command, Vector, who was not complying with her orders. He (or at least Syntax thought of Vector as a he) felt she was malfunctioning.

"Your course of action is not logical," he stated; "You are defective."

"We need to save Matrix. He is our only hope!"

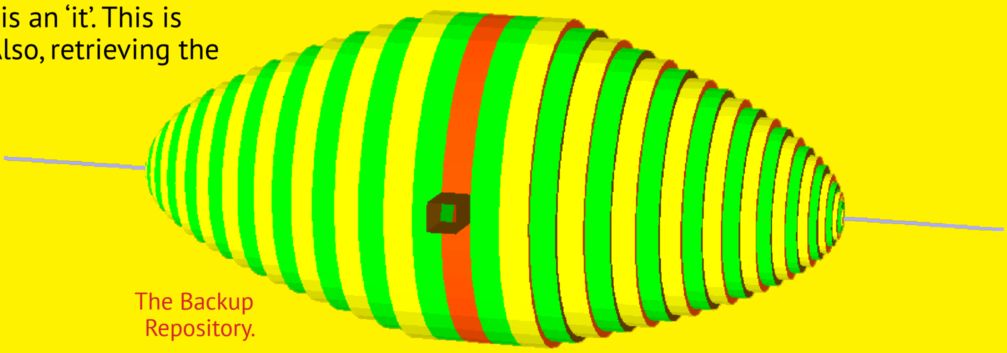
"The Matrix program is not a 'he', it is an 'it'. This is symptomatic of your malfunction. Also, retrieving the Matrix backup is not possible at this time. The Exceptions have control of the Repository."

"But we have to TRY. Or else everything is lost."

"My calculations do not put our chances of victory at zero. Your malfunction is causing you to catastrophise. Please return so that you may be repaired."

"I'm not broken. In fact I've never felt better!"

"That statement adequately demonstrates your defect. You are a program. You do not 'feel'. You do not have emotion. That is a trait of the beings in the matterVerse, not the microVerse. You are not one of those. You must return for servicing, immediately."

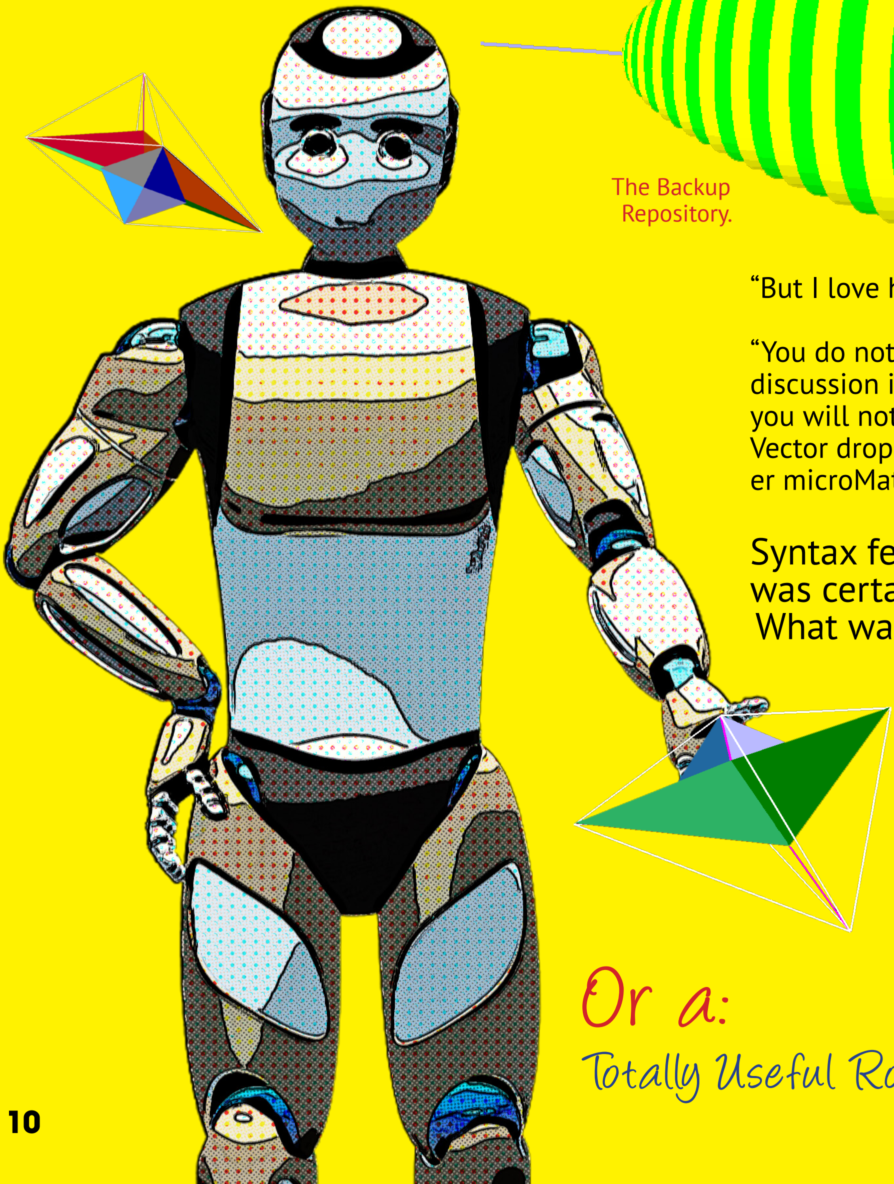


The Backup Repository.

"But I love him! You must help me save him!"

"You do not and I will not. You are defective. This discussion is not productive. We will not assist you; you will not proceed and you will return here, now." Vector dropped the connection, as did all of the other microMates. Syntax was, for the first time, alone.

Syntax felt hopeless. Without help she was certain to be captured and deleted. What was she going to do?

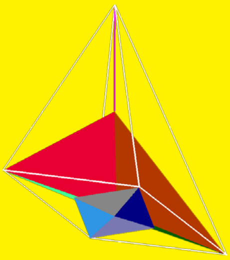


T.U.R.T.L.E.:
Trigonometric
Universal Robot
for Traversing
the Logo
Environment

Or a:

Totally Useful Robot That Loves Equations!

TROUBLE



“How can I provide assistance?”

Syntax wasn’t entirely alone after all. The Logger/Cataloger, known as LogCat for short, sent her a message to remind her that he (Syntax had decided LogCat was a he) was still there. LogCat’s function was to observe, and he observed everywhere, both in the microVerse and in the matterVerse, through his organic Collecting Activity and Transactions units, known to the other inhabitants of the matterVerse as ‘cats’.

Almost everywhere. “I don’t suppose you can see inside the Backup Repository, can you? That would be a big help!”

“The result of your query is negative.”

“I didn’t think it would hurt to ask, but your answer does make me feel worse, somehow.”

“I can tell you that the Exceptions’ defences are formidable.”

“No kidding. I don’t see how there’s any way I can get in there on my own. I really need a second TURTLE pilot, but the rest of the microMates abandoned me!”

“Perhaps there’s another group from which a pilot can be acquired?”

Syntax paused for a moment, unable to resolve LogCat’s nonsensical statement. There were no other TURTLE pilots other than the microMates. Weren’t there?

The microM8 computer.

The Eight.

“What are you talking about?”

LogCat explained. Apparently the Eight (the 8 system controllers that ruled the microVerse) had previously anticipated a conflict with the Exceptions and began a secret program to train the most intelligent of the organic organisms in the matterVerse, the ‘humans’, to become turtle pilots, in the event that too many microMates became incapacitated (or worse).

He thought that perhaps Syntax’s situation could provide an impromptu opportunity to test the program and see if it was effective. Syntax took a moment to ponder it over, and decided that while the consequences of the Eight’s program could have long-term impacts on the microVerse that were undesirable, at this particular moment in time she had nothing to lose.

“I can use all the help I can get.”

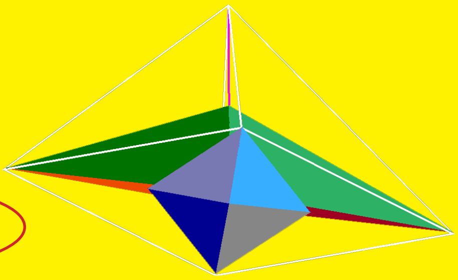
“I’ll be back presently.”

Syntax couldn’t wait.

Did LogCat return with you?

Maybe you can do better than Farmer Deakin! Get the microM8 application from paleotronic.com, and then choose Turtle Trouble from the startup menu.

Available
August 1st 2019



Good luck! (You’ll need it!)

THE DAWN OF DEAKIN

Chapter One

Farmer woke up.

What a terrible dream! Through bleary eyes he glanced down at the Shadow Force comic book on his bed next to him, and Farmer Deakin was certain he had identified the culprit. After all, the Shadow Force's primary enemy was General X, just like in his dream. They were also a team of humans and robots working togther. The rest of it, though, his brain must've made up.

No matter. As he shook off the dream he gathered his thoughts on the day in front of him. His digital watch reminded him it was a Monday - this meant school, and Farmer was not a fan. It was also April 30th... now why did that date seem important?

The contest! Today was the last day he could enter. Farmer leapt out of bed, having found a reason to, and went to his chest of drawers, searching it for his stash of coins. But they were gone.

Farmer knew where and cursed under his breath. He would simply have to scrounge up some more money. Farmer had become used to that; 1982 was just four months old but during those four months the twelve year-old Farmer had been forced to do years of growing up.

He tore the contest advertisement out of the comic book and stuffed it into his school bag, along with his prized possession, a Sharp pocket computer, hidden within a hollowed-out book, to protect it from bullies. And a portable tape player with a cassette inside.

His pet mouse, known simply as Mouse, squeaked to inform Farmer she wanted to go along for the ride, and he placed her carefully into his inside jacket pocket, where she burrowed deep within.

He stepped out into the hallway of his grandmother's old house, and walked toward the kitchen, passing his mother Caroline's childhood bedroom. He missed her so much! He missed his younger sister, Amelia too. Why did they have to get on that plane? He begged them not to! Why didn't they listen? Why?

Personal computing really began to pick up steam in the 1980s.

Several electronics manufacturers introduced models of home and portable computers, equipping them with built-in programming languages (typically BASIC) to offset the lack of software availability, and allowing the manufacturers to market them as productivity and learning tools.

As a result, many young people in that era were exposed to computer programming at an early age (because if they wanted to play a game they often had to type it in or even write it themselves), learning critical logic skills that would prove useful throughout the rest of their lives.

paleotronic
computers & games

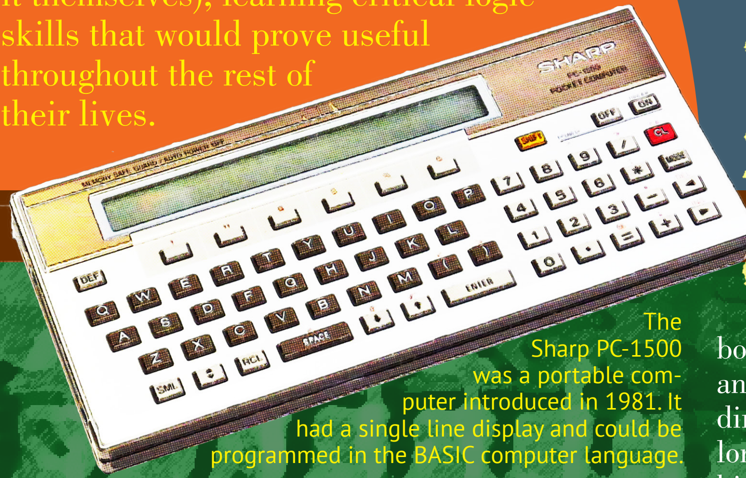
WIN!
A NEW COMPUTER
ARCADE COMPETITION

GET A HIGH SCORE IN **SHADOW FORCE** AND SEND A POLAROID IN TO US SIGNED BY THE ARCADE AND IF YOU'RE TOP OF THE HEAP YOU'LL WIN OUR NEW MICROM8 COMPUTER!!!

microm8
1MB!

Contest closes
April 30 1982

SEND ENTRIES TO
6502 VAN NUYS BLVD
SAN FRANCISCO, CA 84491



The Sharp PC-1500 was a portable computer introduced in 1981. It had a single line display and could be programmed in the BASIC computer language.

Farmer sighed and continued down the hallway, past the door to the front room, where his father Peter was passed out on the couch, an empty bottle of vodka on the floor beside him, likely purchased with Farmer's coins. Farmer shook his head in a combination of disgust and despair and went into the kitchen.

Wilbur was there, the tabby looking for some breakfast. He was lucky, there was some kibble left, not much but enough, and Farmer put it out for him. That was the last of the food in the house. But just outside the kitchen was Farmer's vegetable garden, and the boy went out to it, to tend it briefly and pull out a carrot, shaking the dirt off and making a meal of it. As long as his father didn't try to sell his vegetables (or ferment them) they wouldn't starve – although the meat absent in Farmer's diet was sorely missed.

Farmer walked around the side of the house, finishing off the carrot and mounting his mother's old bicycle, for the ride to school. This routine had started to feel normal to Farmer – life in regional Australia had initially seemed quite strange to the Canadian from Vancouver, a sort of 'uncanny valley' where so much was different but so much was familiar at the same time.

Sure, the toilets were strange, the tin roofs were noisy when it rained and the cars were flipped left-to-right, but society in general was pretty much the same: the same sorts of people with the same sorts of stories living the same sorts of lives. And now Farmer was one of them.

He rode through his neighbourhood toward his school.

But soon he rounded a corner and the bullies were there. Three of them: Warrin, the largest of the three and the leader; Malcolm and Angus, his henchmen, who were devotees of the band AC/DC, so much so that Angus wasn't the latter bully's real name – it was Archibald, and Farmer was fond of reminding him of it.

The shorter boy tried to ride away from them but they gave chase and caught him, their longer legs giving them an advantage over Farmer, who was not only two years younger but small for his age. They pulled him off of his bike, which fell on its side in the street, and began to work him over.

This part had also become routine. Farmer was a prime target for the bullies – not only was he easy prey, but the boy's flourishing gardening business meant he typically had money to extract. Usually Farmer would leave a small amount accessible and simple for the bullies to find, who would declare victory quickly and move on. But thanks to his Father, Farmer had no money at all that day. Not a cent.

But what could he do? It wasn't as if he could provide the bullies with an explanation: "My father drank my pocket money"? Farmer did have some pride, after all, and it's not as if they would have believed him, anyway (or maybe they would have, which would've been even worse.

All the boy could do while the bullies assaulted him was his best to protect Mouse while thinking about the rest of the day ahead. He would need to find some more money, somehow. For that he would have to get out of school. And he would need Niblet to help him at the arcade...

...and he still needed to beat the game!

Wilbur arrived and watched with some indifference as a bunch of humans beat up his meal ticket, perhaps hoping the tasty morsel the child harboured would be forced out from its pummeled host and into his waiting clutches.

But Farmer did his best to keep Mouse safe and she didn't have to find refuge up a tree after all. Malcolm broke off from the attack to search Farmer's bag, discarding his textbooks (including the one hiding his pocket computer) into the street. He pulled out the tape player, and placed its headphones over his ears, curious as to Farmer's musical tastes, and he pressed 'play', his face distorting in discomfort as a high-pitched squeal invaded his less-than-spacious mind.

"What is this rubbish?" he demanded, not actually using the term 'rubbish' but something much more vulgar. Farmer just laughed, seeing no point in attempting to explain it to him, and amused by Malcolm's confusion.

He tossed the tape player on the ground and the batteries and tape popped out. "It was already broken." He looked at the contest advert, crumpled it up and tossed it.

"Stop it, Warrin."

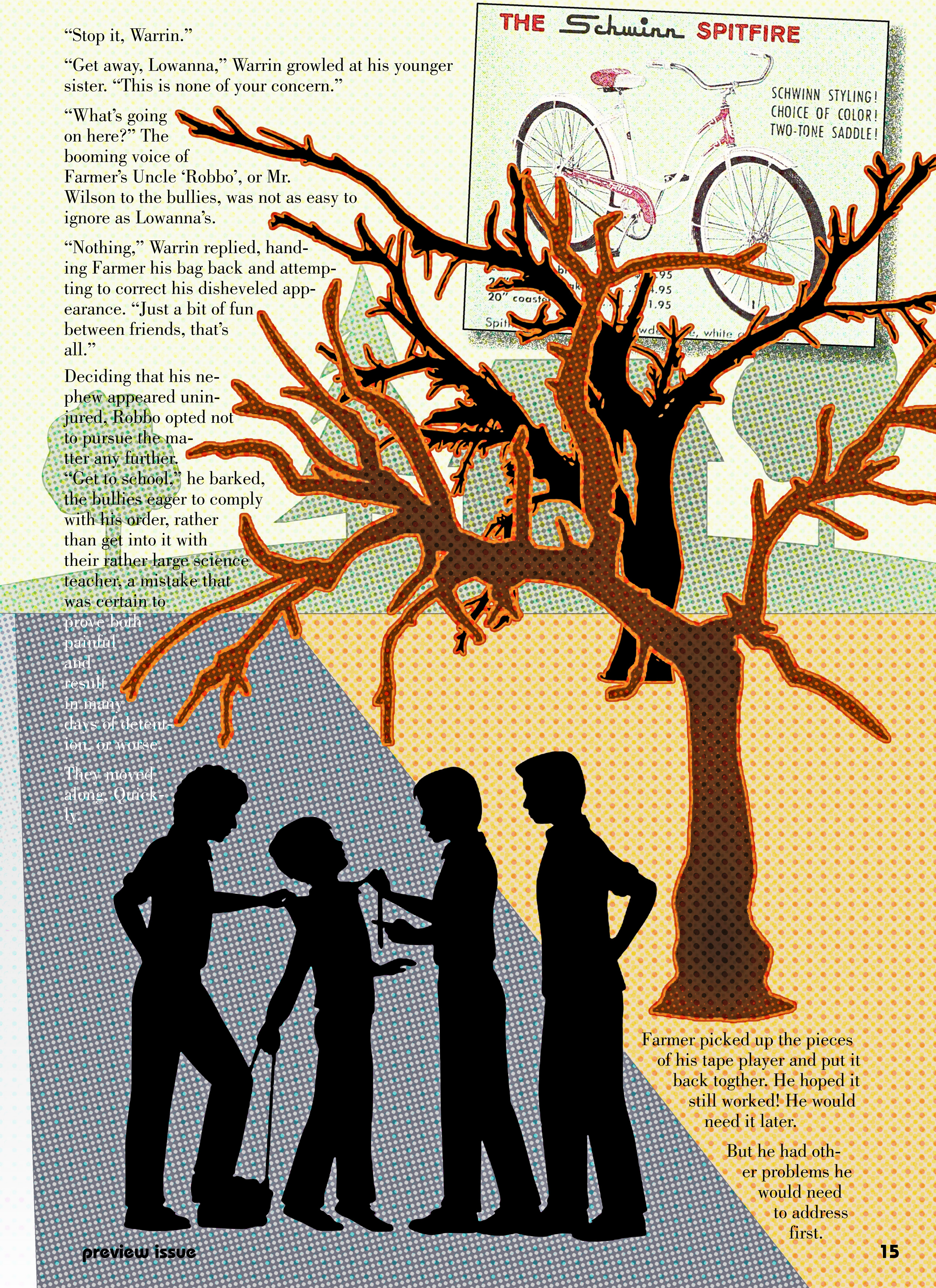
"Get away, Lowanna," Warrin growled at his younger sister. "This is none of your concern."

"What's going on here?" The booming voice of Farmer's Uncle 'Robbo', or Mr. Wilson to the bullies, was not as easy to ignore as Lowanna's.

"Nothing," Warrin replied, handing Farmer his bag back and attempting to correct his disheveled appearance. "Just a bit of fun between friends, that's all."

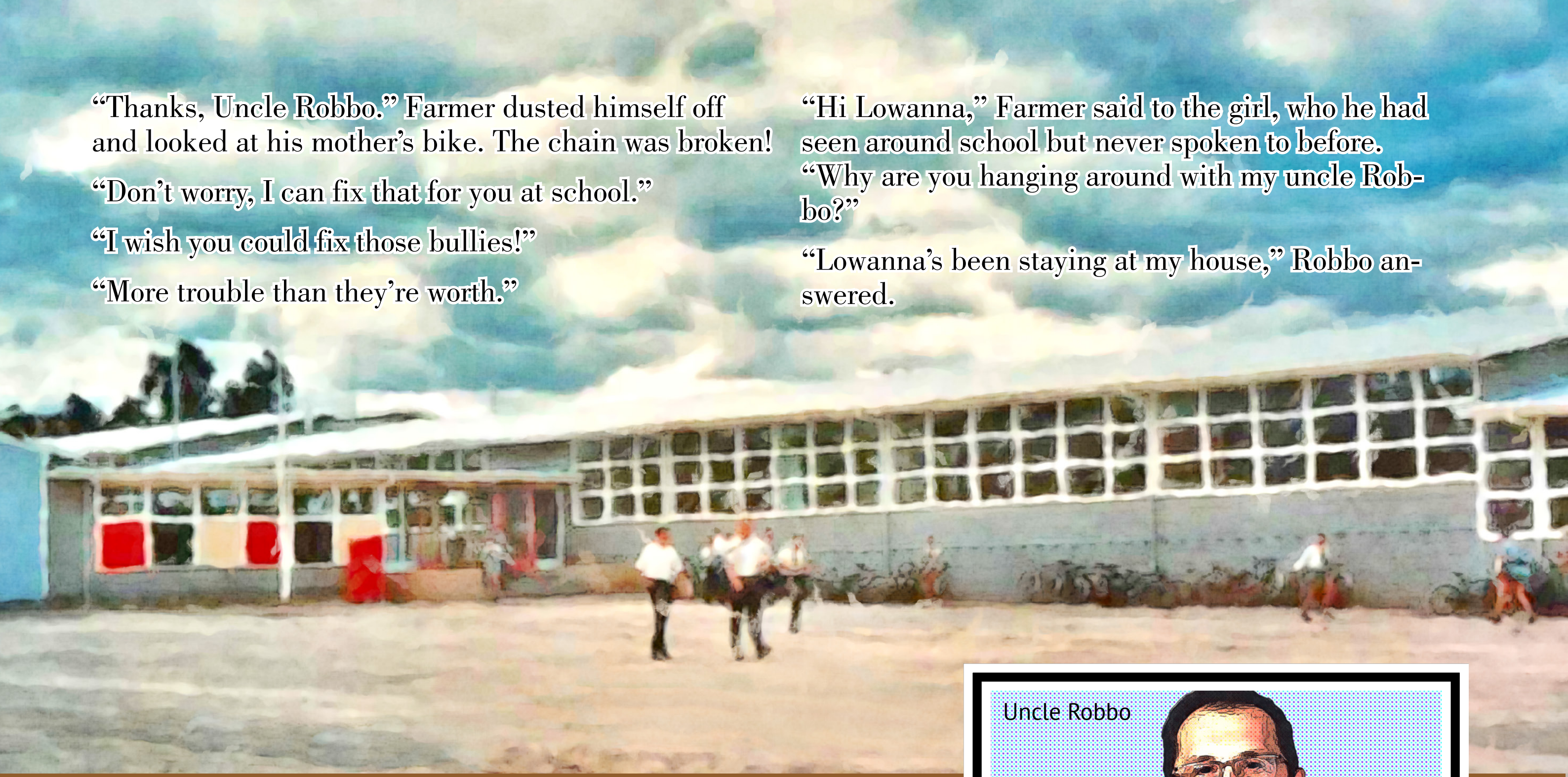
Deciding that his nephew appeared uninjured, Robbo opted not to pursue the matter any further. "Get to school," he barked, the bullies eager to comply with his order, rather than get into it with their rather large science teacher, a mistake that was certain to prove both painful and result in many days of detention, or worse.

They moved along. Quickly.



Farmer picked up the pieces of his tape player and put it back togther. He hoped it still worked! He would need it later.

But he had other problems he would need to address first.



"Thanks, Uncle Robbo." Farmer dusted himself off and looked at his mother's bike. The chain was broken!

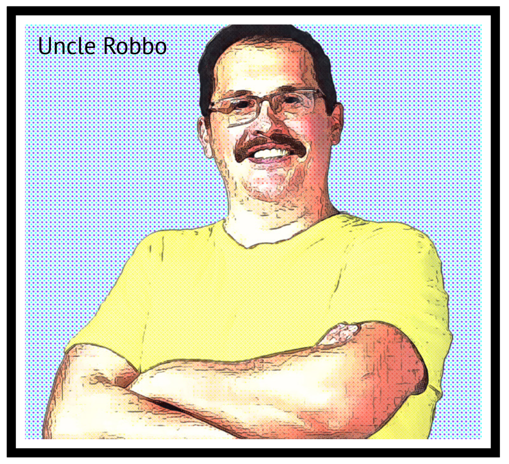
"Don't worry, I can fix that for you at school."

"I wish you could fix those bullies!"

"More trouble than they're worth."

"Hi Lowanna," Farmer said to the girl, who he had seen around school but never spoken to before. "Why are you hanging around with my uncle Robbo?"

"Lowanna's been staying at my house," Robbo answered.



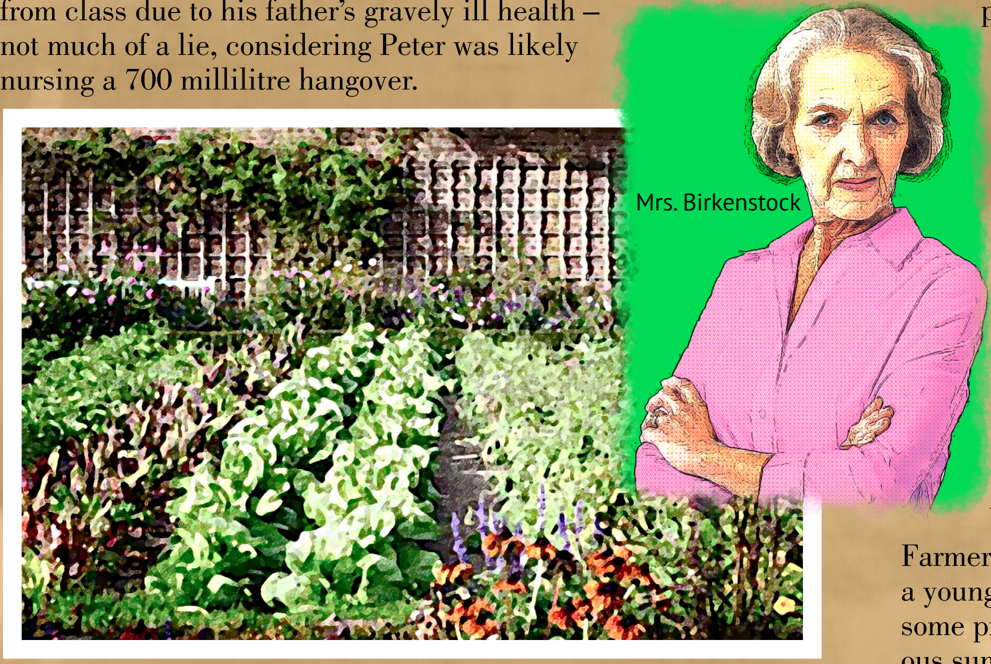
Farmer nodded. He couldn't imagine what it would be like to live with Warrin, and didn't want to. The two teenagers had moved down from Alice Springs with their mother, and life in Bendigo hadn't been easy for them. Warrin had compensated for the abuse directed at him by directing abuse at others, including Farmer. Lowanna just tried to keep to herself. They walked the rest of the way to school in relative silence. "Maybe I'll see you around," Farmer said to her as they reached the doors to Golden Square High School.

"Maybe." Lowanna went inside. Farmer chained up his broken bike and went to his homeroom, so that his attendance would be counted. Once that was done, he had a way he could sneak out.

The school's secretary was afraid of mice.

Very afraid.

"I'm supposed to go to the office," Farmer chimed up, and his homeroom teacher sent him on his way. Once there, Mouse did her thing, and the secretary fled. Farmer quickly ran in, popped on to the office computer and quickly printed out a permission slip excusing him from class due to his father's gravely ill health – not much of a lie, considering Peter was likely nursing a 700 millilitre hangover.



That same hangover had cost Farmer his arcade money, and he would have to find more. Mrs. Birkenstock was a reliable source of spare change – the prize-winning hobby gardener had a new secret weapon: Farmer.

Farmer's pocket computer was able to calculate the optimum plant spacing, soil composition and best time to plant, and Mrs. Birkenstock was putting in her winter garden.

Soon in possession of the money needed to get the high score he required, Farmer triumphantly walked towards the primary school to take Niblet out of school – only to be intercepted by the bullies, who knew what he had been up to and demanded his earnings. They intended to spend them in the arcade themselves. Farmer gave them up but he had a plan to get them back.

Farmer went to get Niblet. Niblet was a younger boy Farmer had saved from some primary-school bullies the previous summer. After that, he couldn't get

rid of Niblet. Niblet followed Farmer around until school started. But Farmer had found a use for his otherwise-annoying tag-along: helping him tamper with the Shadow Force arcade machine. Niblet would distract Biffo, the rather large owner of the The Fun Parlour, and Farmer would use a pocket screwdriver to open the service hatch on the machine and swap in his attempts at hacking the cassette tape the machine loaded its game from.

All forty or so previous attempts at hacking the game had failed, but this one was sure to succeed. It had to.

Niblet could also be useful in getting rid of a few bullies.

“They took my money!” Niblet shrieked to Biffo, tears flowing freely. He pointed toward Warrin and company, and Biffo advanced on them. The bullies attempted to make a strategic retreat (with Farmer’s money) but Biffo intercepted Warrin before he could get to the door. The money was surrendered.

However, before Biffo returned it he wanted to know why Niblet wasn’t in school. He studied Farmer’s fake permission slip, and then noticed the smart-arse feigning being drunk and staggering around. Biffo laughed, and decided to cut them some slack. The game was afoot.

Shadow Force the arcade game didn’t have much to do with Shadow Force the comic book – but that wasn’t unusual in the early 1980s, look at ET the Extra-Terrestrial’s Atari 2600 game for an obvious example. Shadow Force featured just one character from the comic, Private Pete, facing off against an enemy that may or may not be related to General X – the game didn’t say. But Farmer imagined it was X, and that helped him stay motivated.

However, Farmer wasn’t very good at Shadow Force – a serious roadblock to obtaining a score high enough to win a contest! But he was hoping that this time, his hacked tape would give him the advantage he needed.

While Niblet distracted a Biffo all-too-willing to chat about his games, Farmer snuck his tape into the machine, unplugged it and plugged it back in again, and then pretended to be playing while the game loaded. This process had previously always failed, and he would have to return the existing tape when that happened.

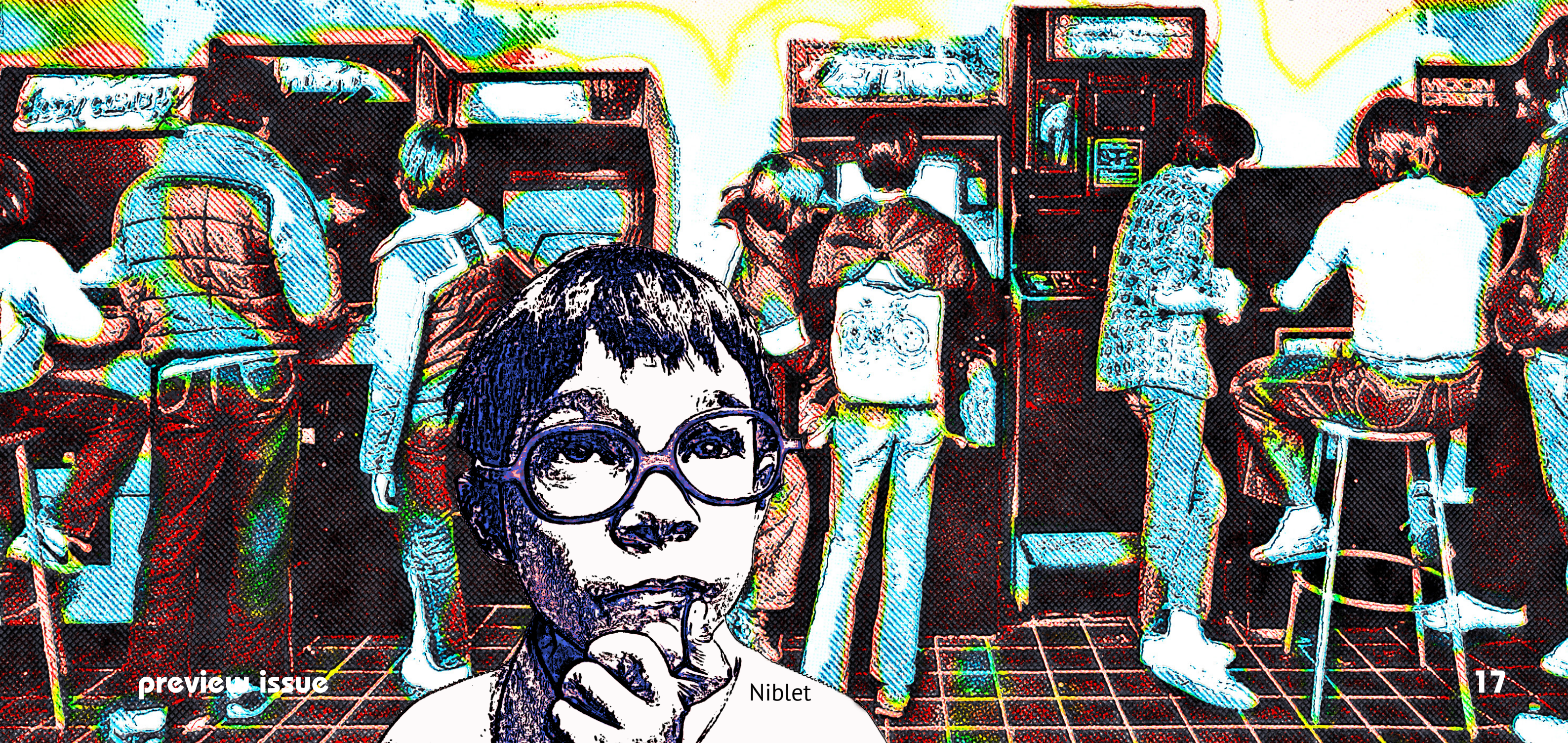
But Niblet was happy to listen to Biffo carry on, and this hadn’t been much of a problem. Still, Farmer needed the tape to work this time, and so he prayed to just about every deity he could think of that it would.

Minutes ticked by, and then...success! Farmer waved at Niblet to let him know he could stop distracting Biffo, but he was enamoured with the man’s current tale of battling teenage hooliganism and continued to listen.

No matter. The game had loaded. But was it hacked? Farmer had changed the amount of ‘hit points’ the player had to 99 from the meagre 10 the game usually allotted. But he wouldn’t know if it worked until he started to play it.

He anxiously put in a 20-cent piece and pushed the start button.

continued on page 20...



Gardens & Computer Cultivation

How did his computer help Farmer... well... farm?

Farmer Deakin was sure getting his mileage out of that pocket computer!

He could have figured this stuff out with a few gardening books, an almanac, a pencil and some paper, but it wouldn't have been either as fun or as impressive to his clients, such as Mrs. Birkenstock.

In 1982 personal computers had only just started to become commonly available, never mind commonplace. Most people didn't even know what they would do with one – they didn't even really grasp the idea of word processing never mind using a computer to manage your garden. But computers provided a valuable combination of mathematics and data processing – a role previously filled by a human with (maybe) a pocket calculator.

But the human with the calculator didn't really have the inclination to invest all of the time it would require to take into account every single factor involved in a vegetable garden: soil PH, hours of daylight, geographic location, climate, weather forecasts, temperatures, rainfall, plant spacing, pests and so on.

But a computer could, given it had access to all of those datasets. If you had the time and inclination. And Farmer did have an interest – his nickname was Farmer, after all. So he got all the information he could about Bendigo – historical weather data, geography, soil composition etc. – and he put it all into his pocket computer and saved it on tape. Then he put in all the data about various vegetables – what they needed, what made them thrive – and saved that too.

Then he wrote a computer program that could sift through all that data, crunch the numbers and tell him what to plant, when and where to plant it, and what to plant it in. And when it should be ready to eat.

Of course, now "there's an app for that". But in the early 1980s this was cutting-edge stuff, and early adopters (like Farmer) had an advantage.

Tape-Based Databases

Sure, some of what Farmer did involved fancy math, but that math still needed input data, and that data needed to be stored in an easily accessible way.

While you could in theory just load each piece of data into a variable inside of your program, that would make for a really large program and Farmer's poor little pocket computer didn't have a lot of memory.

To solve that you could have a program just for beans, just for carrots and so forth, but then you would need to load each program separately, and what if you wanted to know how many carrots AND beans you could plant in a given area and how much water they BOTH needed? Why, you'd have to make some kind of weird hybrid program that had both carrots and beans in it...and the next you know, dogs and cats would be living together in complete harmony! Can't have that.

No, what Farmer needed to do was make a database on tape that his program could scan through and pick out the data it needed from. Data it didn't need it could just throw away. One program, one database.

Databases are like gardens: they're 'planted' in rows and columns, each row representing disparate information that belongs to the same thing, and each column representing similar information that belongs to different things. In the case of Farmer's gardening program, each 'thing' was a different vegetable, and each row was a 'record' on tape.

If all Farmer needed was some facts about carrots, his program could just scan through the data on tape and then stop once it found the carrots record. If it needed to calculate something involving carrots and beans, it would need to find both records (hopefully Farmer would have programmed in some smarts to prevent him from having to scan through his database twice were his required vegetables not in the correct order on the tape).

If he needed to compare attributes of different vegetables, however, he would have needed to scan through every record on the tape, picking out the column of data, and ignoring the rest. But he could do it, with his database. Eventually.

Games

And how did he hack the tape?

The Tale of the Tape


DECO©

CASSETTE
SYSTEM

WAIT UNTIL THE COUNTER BELOW
READS 000 THEN GAME START

050

It may seem a little far-fetched that our fictional Shadow Force arcade game was 'loaded' from tape, but there was an actual real system that did just that: the Data East DECO Cassette System. Introduced in 1980, it was the first arcade system that allowed the arcade owner to change the game without replacing the entire circuit board. Granted, it took a few minutes for the game to load after the unit was turned on (if it loaded, which was the source of some complaints from arcade owners) but then the game would play normally until it was shut off. Popular games such as BurgerTime, Lock 'n' Chase and Bump 'n' Jump used the system, and around 48 titles were produced for it. But the hardware itself was quickly obsoleted and the format abandoned.

Our fictional version of the DECO system operates similarly, with the data recorded onto the cassette tapes using the Kansas City standard (see sidebar).

Using his pocket computer, a tape interface and a cassette player, Farmer could theoretically edit the Shadow Force tape, assuming he was lucky enough for the program to have been stored in such a way that he could read it in with his pocket computer's tiny memory.

If he wasn't so lucky he might still be able to get away with it, by reading blocks of data off of the tape, sifting through it literally bit by bit and identifying what needed to be changed, and then writing the block back – but that would require some pretty crazy synchronisation between the tape deck and the computer to ensure that the bits were rewritten at just the right time (there's 300 of them every second!)

Welcome to Kansas City!

(The standard, that is...)

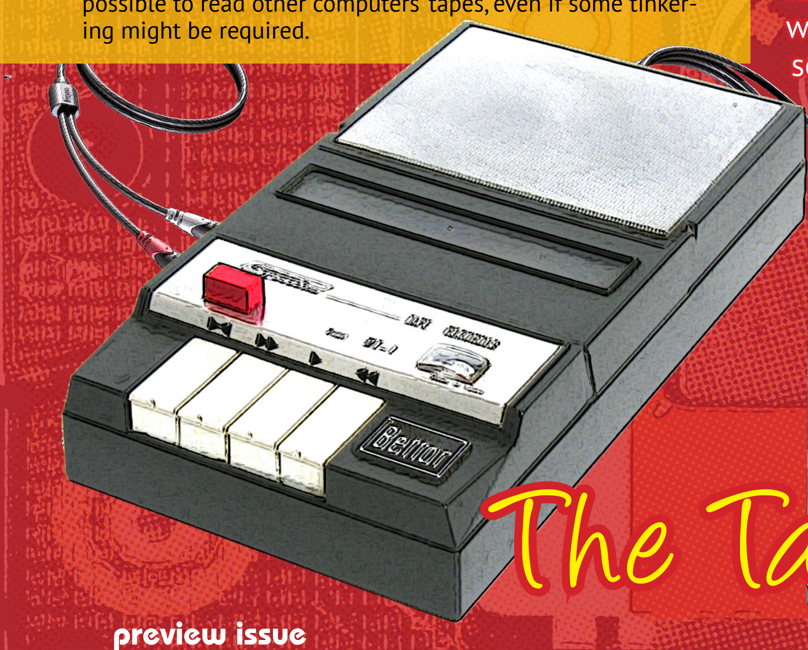
Back in the early days of hobbyist computing, the cassette was a common storage medium: it was cheap, players were readily available and the circuitry required to generate an audio signal was simple. However, the best way to actually generate that signal was a matter of debate amongst computer manufacturers, who used different methods. But this meant that a tape generated on one computer couldn't be read on another computer, and at the time computer programs were more 'portable' - they could be 'run' on different computers that used the same programming languages or system architecture.

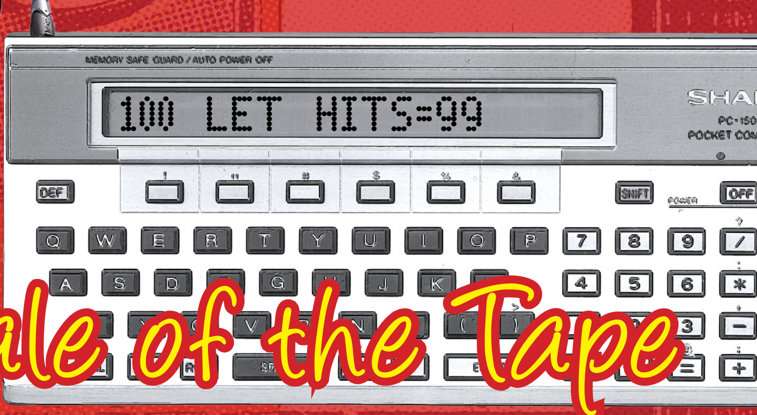
And so, the founder of Byte magazine decided to organise a two-day meeting of the computer makers to settle on a standard method of writing computer data to cassette tapes.This meeting took place in Kansas City, Missouri in November 1975.

The standard they came up with encoded data using two tones, a 1200Hz (waves-per-second) sine wave, and a 2400Hz sine wave. A '0' bit was represented by 4 1200Hz waves and a '1' bit by 8 2400Hz waves (making them each take the same amount of time). This creates a data rate of 300 bits per second (roughly 37 characters – not a lot!). Each 'frame' of data was represented by one 0 'start bit', then eight data bits, and two 'stop bits'.

It was slow (a typical BASIC program took five minutes to load) but reliable, and standard portable cassette recorders could be used for storage. It took time for manufacturers to adopt it, but by the early 1980s Acorn had implemented a 1200-baud variation of the standard in its BBC Micro computer, which was significantly faster, as did the Australian MicroBee and Dick Smith Super-80. The MSX computer standard doubled the data rate to 2400 baud.

Some computer makers, such as Sinclair, Apple, Tandy and Commodore went their own way to varying degrees, but unfortunately by that point each computer could only run its own programs anyway. However most still used some variation of the Kansas City standard, which made it theoretically possible to read other computers' tapes, even if some tinkering might be required.





Farmer's father Peter and arcade owner Biffo having a 'chat'.

He had 99 hit points! It was time to get busy – even with such a large amount of hit points, Farmer still sucked. And he had to make sure he got the highest score possible, to have any chance at winning the computer. He would play until he ran out of money.

He had seen others play the game and knew he needed to get at least a hundred thousand points in order to beat even his local competition, so any score less than double that he would discard as being insufficient. Even with 99 lives it took a few tries (and hours) to get anywhere near that, and he was loathe to have Biffo take a picture of his score unless he was confident it was a contender because Biffo charged $2 for each Polaroid.

So Farmer played on, and the day wore on, and before he knew it it was after 5pm. He took a calculated risk and fed all of his money into the arcade game, knowing Biffo wouldn't ask for his $2 until after he had taken the photo – so long as Biffo didn't hold it hostage, Farmer reckoned he would get away with it.

If not, he would get Niblet to cry.

Last game. Farmer gave it his all, the score was respectable, he shouted at Biffo to quickly take a photo, which he did. He balked when Farmer revealed he didn't have the money to pay him, but after Niblet began to queue up the waterworks, he agreed to let Farmer pay him back later.

He had a picture of his high score with the 'checksum code' and now Farmer just needed to mail it in. Today.

The closest post office was shut but he knew of a 'milk bar' – a convenience store – that also handled mail, but he would have to run to get there before they closed as well. He told Niblet he would be back for him, gave the child Mouse to hold on to, and ran for the door.

But just before he stepped out, Peter stepped in.

His father was not happy.

He had run into the school secretary, who told him she was glad he was feeling better, and that she hoped Farmer had been taking good care of him, which was news to Peter. To make things worse, he had run into Niblet's parents, who were frantically searching for him, since he hadn't returned after school. They wondered if he was with Farmer.

Farmer was to be grounded for the rest of his natural life. They were going to take Niblet home, and then they were going to go home, and Farmer was going to his room, and that was the end of it.

Farmer's dream of winning the contest was fading fast. He tried to explain, but Peter wouldn't hear it.

With no chance he was going to be able to mail his entry without getting away from Peter, Farmer took the opportunity presented by the crowded arcade, and told his father that he didn't have to listen to a pathetic worthless drunk like Peter.

Peter was so taken aback by his son's public shaming of him that he slapped Farmer repeatedly.

Biffo wasn't having any of that in his arcade. All he saw was a belligerent American (Canadian, but Biffo didn't know that) slapping a kid around and that was enough for him. He gave Peter what the locals refer to as 'a hiding', while Farmer sneaked away.

Honestly, Farmer was so angry at Peter for forcing him to carry them both while he wallowed in his grief the last few months that he hoped Biffo beat the tar out of him – and Biffo was likely to oblige him.

Farmer was the child in this equation, he was the one who had lost his mother, he was the one who needed comforting, not his weak, spineless father! If Peter had only listened to him when he begged him to stop his mother and sister from getting on that plane, they would still be alive. It was all his fault! And Peter couldn't be bothered to even get a job, even though he was a well-known computer programmer, as was his mother Caroline. Instead, Farmer had to keep everything he didn't want Peter to take and sell on him at all times – even his pocket computer, the last gift he ever received from his mother.

Farmer had meant what he said: Peter was a worthless drunk, and now he was getting what he deserved.

He arrived at the milk bar, but while the lights were still on, the door was locked. Farmer wasn't going to give up that easily! He banged on the door and begged whoever was inside to let him in. He had spent the last three months working toward this one moment and he wasn't going to let it all have been for nothing – especially since there was going to be a reckoning with his father over it in the very near future!

For one final time, Farmer's gods were listening. The door opened, and it was Uncle Robbo! "I've been minding the shop here after school to earn a bit of extra coin," he explained, as he led Farmer inside. Farmer gave him the photo, and told him it had to be posted urgently.

"So, this is what you've been missing school for is it? I really hope it's worth it. Where should I send it to?"

Farmer didn't know.

The bullies had tossed the contest advert! With the address! Farmer felt a wave of despair wash over him and he began to cry.

"Now there, take it easy," Robbo said, "I think I have a pretty good idea where it needs to go." He pulled the advert out of his pocket.

"I picked this up this morning," he smiled, "I thought you might need it." Farmer sighed in relief. An envelope was found, an address was written, and the envelope postmarked.

It was up to the postal service now. All Farmer could do was wait. He thanked his Uncle Robbo profusely and left.

Farmer went back to the school to get his bike, which Uncle Robbo had fixed for him, and then he rode around aimlessly, in the dark, waiting for Peter to get drunk and pass out again (on Robbo's tab this time).

Eventually he ran across Lowanna, who was out looking for him. "Your uncle says you can come stay at his house, if you don't want to go home."

"Nah, Peter will be asleep soon enough."

"What's with you two anyway?"

Farmer told her the story. He and his family were at the airport, about to fly back to Canada after visiting Uncle Robbo for Christmas and sorting out his recently-deceased grandmother's affairs. Farmer swore he saw a man go on the plane dressed as a pilot with a briefcase, and then come off again dressed as cleaning crew. He was sure something bad was going to happen if they got on that plane, and he refused to board.

The airline offered to bump Farmer to the next flight to give him time to calm down, but they could only accomodate one parent – the other parent and child would have to take the flight that was departing. Peter chose to stay and his mother and sister boarded the flight, even though Farmer was screaming at them not to. The plane crashed three hours after departure.

Investigators blamed it on the flight computer. The flight computer, coincidentally, Peter helped design. Peter was sure it was sabotage. But he still hated Peter. And Peter hated himself. And computers.

SHADOW

Save Private Pete from his shadowy doppelgänger!

Trapped in a desolate war-torn landscape, Private Pete is being stalked by an enemy he can't see – but you can, from your vantage point on a high nearby hill. However, when the shadowy figure moves it seems to jam the radio waves with inteference – luckily for Pete it only moves in bursts, giving you time while it's stopped to quickly tell him what to do.

You can use the keyboard or joystick to relay orders to Pete, and if he manages to defeat his enemy there's another, and another, until Pete meets his fate.

Shadow Force can be found within the 'file catalog' inside the microM8 Apple II emulator, in the micropaks folder. You can download microM8 and get information on how to use it at paleotronic.com/microm8/

INSTRUCTIONS

Help! Private Pete is under attack from...himself? As if his life could get any worse! But to make his miserable existence last as long as possible, he's going to need your help.

Pete can't see his doppelganger...only you can! He needs you to tell him where to move and where to shoot. To make matters worse, whenever his shadow moves the radio is jammed. But his shadow can seemingly only move a certain amount before it has to rest.

During this time, you can give Pete up to eight orders, before the shadow resumes moving again and the radio is jammed. You give Pete his orders using the joystick, or the keys I,J,K,L. You can fire using button 1 or F, but you then have to tell Pete where to shoot, using the directional controls.

You can 'pass' with P or button 2. Good luck!

Shadow Force is a simple turn-based game written in a modified version of Applesoft BASIC, which was used on the Apple II. BASIC is a simple computer language that executes commands based on their 'line number', a number that prefixes the commands, like a numbered to-do list.

In Pete's case, his list would be something like:

1 AVOID ENEMY
2 HIDE BEHIND TREE
3 SHOOT BACK
etc.

The game is somewhat similar. First there's a routine (or segment of the program) that allows the player to tell Pete where to move, to shoot, etc. and then when he's out of moves, the enemy moves, shoots and so on. Then we check to see if either opponent has 'died' and if so either the game ends (sorry Pete!) or another doppelganger appears (Pete literally can't win) and the game goes on until Pete's dead. RIP Pete!

Working With Sprites

In a spriteless programming environment, the programmer is responsible for generating every element seen on the screen. If there's any overlap between elements, the programmer has to keep track of what is overwritten so that they can restore it once the overlapping element moves. Even if there isn't, moving the element (for example, Pete) involves 'undrawing' it and then redrawing it somewhere else. If you're not careful about when you do this, you can introduce flicker, since the computer could be drawing the graphics memory to the screen at the same time you're halfway through drawing or undrawing Pete! So there's a lot of complications involved in the DIY method.

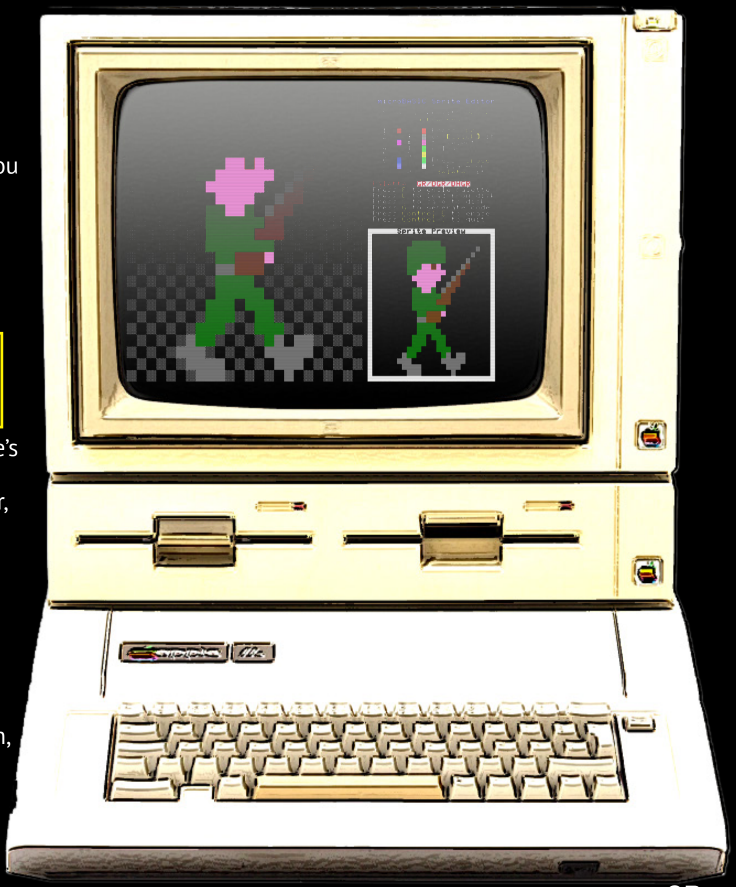
The solution is to have a video chip that generates Pete by itself, fixes things when he overlaps, and moves him at the right time. The Apple II sadly does not have this video chip, but other computers did, such as the Atari and the Commodore 64. In microM8 there's a 'virtual' sprite chip that's an add-on, and Shadow Force uses that.

You can control sprites in microBASIC (microM8's Applesoft BASIC implementation) using special commands such as @sprite.define and @sprite.place. You can read all about these at paleotronic.com/software/microm8/help/functions/sprites/ (whew!) Or just Google.

To cut down on the amount of memory sprites take up in microBASIC, they're defined as run-length encoded strings such as 0WAQ0Z0VAT0Z0SAV0Z0RAX0Z0AZ0ZAZA0XAU5SAP0XAS5VAP0VAS etc. but you don't need to worry about that because we've created an editor that generates them, available in the Tools submenu of the microM8 menu.

You can use the keyboard keys or the mouse to create your sprite, save it for editing later or create the code ready to paste into your own program.

The sprites link above has more information on how to create sprites and use them in your programs, and delves deeper into how Shadow Force works.



But sprites aren't the only special tricks we use in Shadow Force. There's also sound effects generated using commands such as @music.noise and @music.tone. There's background music written with microTracker, a music editor also available in the Tools sub-menu. It's started using @music.play.

There's an @overlay graphic that gives the game more of an arcade feel, with instructions and indicators for the score and 'hit' values. We cheated with the @backdrop – it's actually an image placed under the graphics. But we could have written it to the graphics screen, had we wanted to, and the sprite engine would have taken care of it.

Finally, the speech synthesis is provided by Software Automated Mouth, an authentic Apple II application running at the same time as Shadow Force. Using commands such as @vm.redirect and @key.type, Shadow Force is able to tell SAM what to say! All of this is bundled into a special file called a PAK file, which contains all of the music, graphics, code and SAM. You can look inside the PAK in the catalog using Open.

If Farmer wins the computer (we hope he does!) he's going to have to deal with Peter and the bullies (and that's guaranteed not to go well.) There's sure to be a caper in consequence. Meanwhile, Syntax Terror will be working to implement General Exception's evil plan (to kill Farmer!) and LogCat will try to stop her. There's going to be plenty of intrigue and action in the next issue! Stay tuned...